DATA ACQUISITION & CONTROL

Analog *Volume 6*

A NEW AGE DAWNS

ISA to PCMCIA

ANALOG I/O ACCESSORIES

ANALOG OUTPUT

*Red Asterisk indicates NEW
PRODUCTS in this catalog!

* Blue Asterisk indicates PRICE
REDUCTIONS in this catalog!

PRODUCT GUIDE - Page 64

Part No.	Price
LWIN-DRVR	
CIO-PC2A	
CIO-DIO24	
CIO-DIO24H	
CIO-DIO24/CTR3	
CIO-DIO48	
CIO-DIO48H	
CIO-DIO96	

CIO-DIO192
SSR-RACK24
SSR-RACK08
Solid State Relays
CIO-ERB24
CIO-ERB08
CIO-PDISO8
CIO-RELAY16
CIO-DISO48
CIO-INT32
CIO-PDMA16
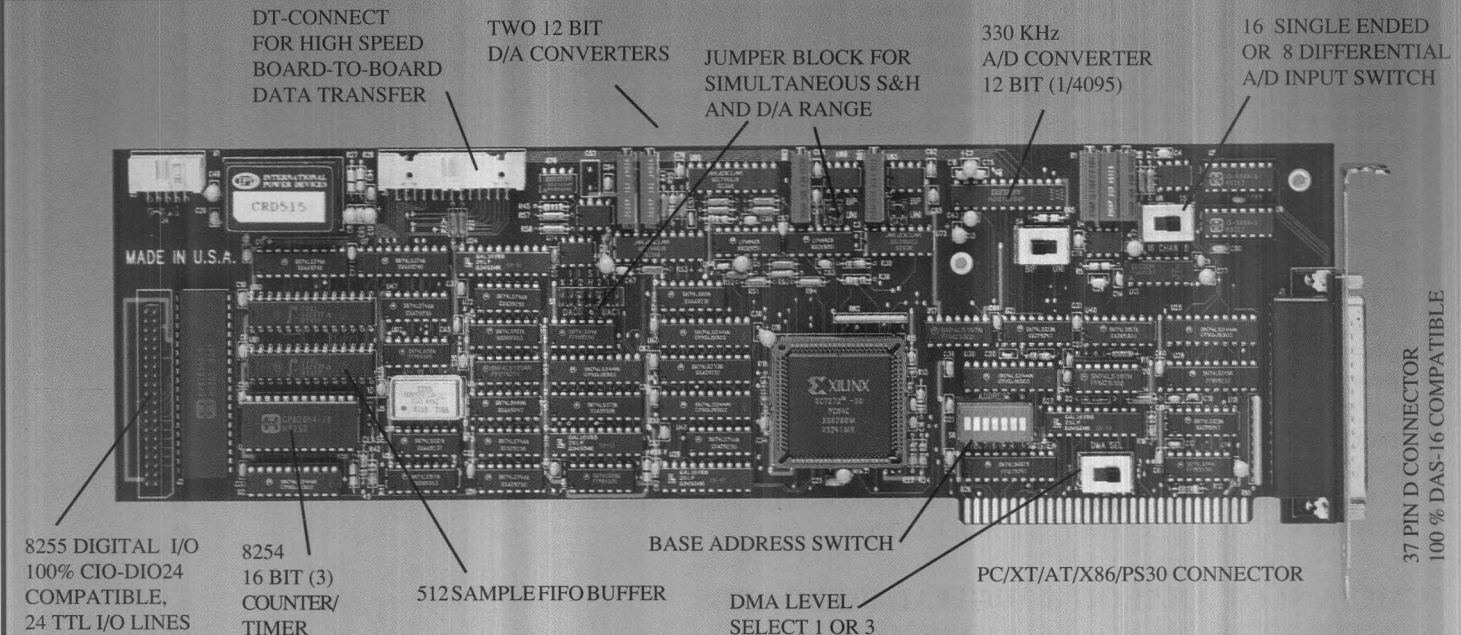
Products shown in the product guide are featured with complete data sheets in the ComputerBoards Digital I/O Catalog, Volume 6

ComputerBoards Analog I/O Catalog, Volume 6

PRODUCT NAME	Description	Page	Price

Contact your local distributor for pricing outside the U.S.A.

CIO-DAS1600/12 & CIO-DAS1600/16

High Speed 16 Channel 12 or 16 Bit Analog Input, 2 Channel 12 Bit Analog Output with 32 Digital I/O & 3, 16 Bit Counters

DT-CONNECT FOR HIGH SPEED BOARD-TO-BOARD DATA TRANSFER

TWO 12 BIT D/A CONVERTERS

JUMPER BLOCK FOR SIMULTANEOUS S&H AND D/A RANGE

330 KHz A/D CONVERTER 12 BIT (1/4095)

16 SINGLE ENDED OR 8 DIFFERENTIAL A/D INPUT SWITCH

MADE IN U.S.A.

8255 DIGITAL I/O 100% CIO-DIO24 COMPATIBLE, 24 TTL I/O LINES

8254 16 BIT (3) COUNTER/ TIMER

512 SAMPLE FIFO BUFFER

BASE ADDRESS SWITCH

DMA LEVEL SELECT 1 OR 3

PC/XT/AT/X86/PS30 CONNECTOR

37 PIN D CONNECTOR 100 % DAS-16 COMPATIBLE

DESCRIPTION

The CIO-DAS1600 multifunction analog and digital I/O board is designed to be 100% compatible with MetraByte's popular DAS-1600 and provide additional features, all at a lower cost.

Installed in any IBM compatible personal computer the CIO-DAS1600 turns your personal computer into a high speed data acquisition and control station suitable for laboratory data collection, instrumentation, production test, or industrial monitoring.

The CIO-DAS1600 is supported by the Universal Driver software to allow programmed control in BASIC, C and PASCAL. Many menu controlled data logging, analysis and control programs are available from a number of third party developers. In fact, any software designed for MetraByte's popular DAS-16 or DAS-1600 will work with the CIO-DAS1600; we guarantee it!

MORE THAN A CLONE

The CIO-DAS1600 is much more than a clone. Extra features include:

1K sample FIFO Buffer. Allows higher speed A/D.
DT-Connect, for high speed inter-board communication.
12 or 16 bit A/D converter, 1 part in 65,535 resolution.
Corrected A/D triggering.

FIFO Buffer = Windows Ready

The FIFO Buffer collects the results of A/D conversions and stores them until the personal computer CPU is able to transfer the data into PC memory. A FIFO buffer allows the PC to store up the A/D transfer requests, then service the requests in batches. Under Windows, many demanding resources employ block transfers. Your A/D board should work in concert rather than conflict with your high performance PC.

The best part about the FIFO buffer is transparency; software you have written for the KM DAS-1600 or CIO-DAS16 will run a CIO-DAS1600 at higher speed without modification. And you won't miss a sample.

A/D

FIFO stores data, PC stores transfer requests. All transfer requests are serviced.

FIFO 512X8

FIFO 512X8

PC Bus Interface
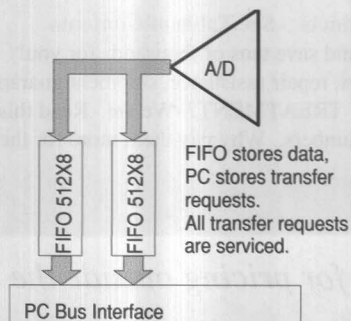
SIXTEEN BIT RESOLUTION & COMPATIBLE

The CIO-DAS1602/16 provides a full 16 bits of A/D resolution (1 part in 65,536). In addition, it is fully compatible with the CIO-DAS1602/12 (KM DAS-1602), including burst mode and gain codes. Because it is a natural extension of the DAS-16 family architecture, the CIO-DAS1602/16 is also register compatible with the KM DAS-HRES.

The only difference between a the 12 and 16 bit board is one register; the A/D least significant byte. Shown here is the LSB register for both the 1600/12 and 1600/16. The 16 bit board the additional 4 A/D bits in the 4 bits allocated to channel number in a 12 bit board.

12 Bit Board A/D LSB

D7	D6	D5	D4	D3	D2	D1	D0
A8	A9	A10	LSb	CH3	CH2	CH1	CH0

16 Bit Board A/D LSB

D7	D6	D5	D4	D3	D2	D1	D0
A8	A9	A10	A11	A12	A13	A14	LSb

Call for Friendly Technical Assistance - (508) 261-1123

ANALOG INPUTS

The analog input section of the CIO-DAS1600 has been re-designed and is a considerable improvement over the KM DAS-1600. Both speed and resolution have been enhanced.

HIGHER SPEED

The CIO-DAS1600/12 boasts speeds greater than 3 times that attainable with the KM DAS-1600. The speed has been improved by changing to a faster (3.3uS) A/D converter with integral sample & hold vs. KM's use of the AD774 (8 uS and external sample & hold (2uS). Both paced and burst mode are faster!

A/D converter throughput is not the only impediment to A/D board throughput. Data transfer method has a dramatic effect on board speed. The CIO-DAS1600/12 and CIO-DAS1600/16 have a FIFO buffer that stores A/D samples and unloads them to the PC bus asynchronously. This method is faster than forced synchronous which the KM DAS-1600 and other KM A/D boards use.

FINER RESOLUTION

The CIO-DAS1600/16 employs a 16 bit A/D converter providing 1 part in 65,536 resolution of the full scale range. Operating at +/-5V range, the CIO-DAS1600/16 resolves to 0.0001526 volts per bit. That is *16 times the resolution* of a 12 bit converter. Higher resolution is slightly more expensive and is limited to 100KHz.

DT-Connect

The CIO-DAS1600 boards can transfer A/D conversions to the PC via the ISA bus, or to other boards via DT-Connect. The DT-Connect board-to-board interface is a standard employed by a number of data acquisition, array and signal processing companies. ComputerBoards makes the MEGA-FIFO sample buffer board which holds up 128MegaSamples of memory completely freeing the PC bus from data transfer overhead. Great for Windows.

Three major improvements to the analog input of the DAS1600!

Of course complete compatibility with the KM DAS-1600 is maintained. Software designed for the DAS-16, DAS-16G, DAS-HRES, or DAS1600 boards will operate the CIO-DAS1600 family without modification. Often with great improvements in speed even with existing routines!

The speed of data gathering is dependent on the method of triggering and data transfer, as the table below illustrates.

A/D TRIGGER/TRANSFER METHOD	MAX A/D RATE 386/20MHz or Faster
CIO-DAS1600/**12**	
Interrupt to Variable or Array	20,000
Direct Memory Access (DMA)	160,000
DT-Connect, multi channel	250,000
DT-Connect, single channel	330,000
CIO-DAS1600/**16**	
Interrupt to Variable or Array	20,000
DMA or DT-Connect	100,000

CONNECTOR

The analog signals are brought on board by a standard 37 pin D connector directly to two multiplexors. The two multiplexors may be configured as 16 channels of single ended input or 8 channels of differential input. Differential inputs can reject noise and ground loops (common mode voltages).

LLGND	19	
CH0 LOW /CH8 HIGH	18	37 CH0 HIGH
CH1 LOW /CH9 HIGH	17	36 CH1 HIGH
CH2 LOW /CH10 HIGH	16	35 CH2 HIGH
CH3 LOW /CH11 HIGH	15	34 CH3 HIGH
CH4 LOW /CH12 HIGH	14	33 CH4 HIGH
CH5 LOW /CH13 HIGH	13	32 CH5 HIGH
CH6 LOW /CH14 HIGH	12	31 CH6 HIGH
CH7 LOW /CH15 HIGH	11	30 CH7 HIGH
D/A 0 REF IN	10	29 LLGND
D/A 0 OUT	9	28 LLGND
D/A 1 REF IN	8	27 D/A 1 OUT
GND	7	26 SS&H OUT
DGI. IN 1	6	25 DIG. IN 0 /TRIGGER
DIG. IN 3	5	24 DIG. IN 2
DIG. OUT 1	4	23 DIG. OUT 0
DIG. 3 OUT	3	22 DIG. OUT 2
CTR 0 OUT	2	21 CTR 0 CLOCK IN
+5V PC BUS	1	20 CTR 2 OUT

VIEW FROM REAR OF PC

The signal levels, functions and pin assignments are identical to the DAS-16 series of boards so applications may be upgraded to CIO-DAS1600 without changes to connector or cable.
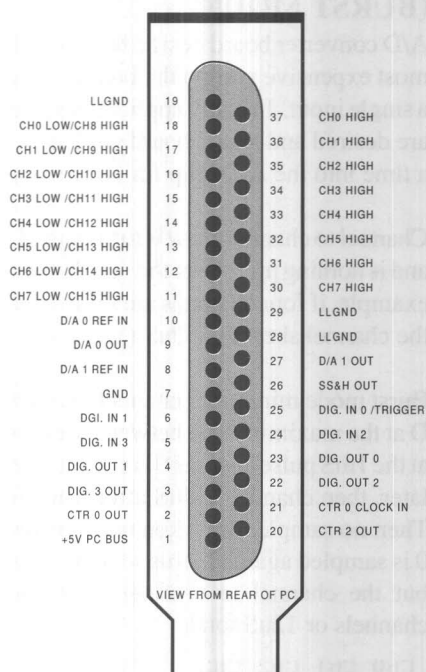
TRIGGERING

A Trigger is the event that begins an acquisition/transfer cycle. There are three ways to trigger a CIO-DAS1600; software, internal or external. There are also three ways to transfer data from the CIO-DAS1600; program, interrupt service routine or DMA.

An internal trigger is useful for synchronizing samples to a known time base; the on board XTAL and 8254 programmable divider. Using an external trigger allows you to synchronize samples to an external event.

The KM DAS16 and ComputerBoards CIO-DAS16 series of boards all trigger A/D conversions on the rising edge of the TTL trigger signal. Surprisingly, KM departed from this standard with the DAS-1600. The DAS1600 is triggered on the falling edge of the trigger signal. The KM DAS-1600 is the only A/D board we know of with a falling edge trigger, and it is *not* a benefit. Using a DAS-1600 with software written for the DAS-16 may result in timing errors due to the change in triggering methods.

TRIGGER EDGE SELECT JUMPER BLOCK

Falling Edge A/D Trigger DAS-1600 Method

J9
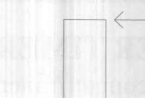
Rising Edge A/D Trigger DAS-16 Method

Default Setting

J9
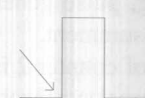
The trigger edge, rising or falling, is jumper selected on the CIO-DAS1600, to maintain compatibility with KM and with the DAS-16 standard. We ship the board in the standard rising edge mode.

at the 1mS pulse channel 0 is sampled, then channel 1 is sampled 4uS later, then channel 2, 4uS after that and channel 3, 4 uS after that. Then no samples are taken until the next 1mS pulse when channel 0 is sampled again. In this scheme the rate for all channels is 1KHz but the channel to channel skew (delay) is now 4uS between channels or 12uS total.
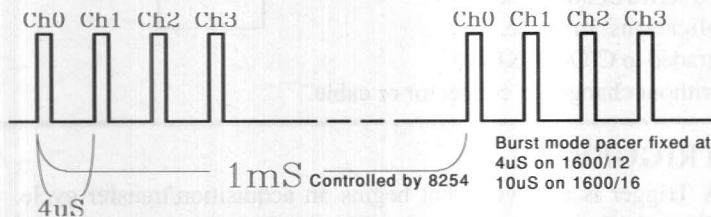
Ch0 Ch1 Ch2 Ch3   Ch0 Ch1 Ch2 Ch3

1mS **Controlled by 8254**

Burst mode pacer fixed at 4uS on 1600/12 10uS on 1600/16

4uS

SIMULTANEOUS SAMPLE & HOLD

Simultaneous Sample & Hold is an option which allows 16 analog input channels to be triggered simultaneously. This option is important to applications where even the minimized burst mode channel to channel skew is not acceptable, such as audio digitization.

The CIO-DAS1600 can trigger an external CIO-SSH16 via the unused D/A REF1 input (pin 26, see block diagram). The CIO-SSH16 reduces CIO-DAS1600/12 channel to channel skew from a minimum of 4 uS in burst mode, to zero, with less than 50 nS aperture uncertainty.

COUNTER TIMER

The 8254 counter/timer chip has 3 counters of 16 bits each. Much of the 8254 is used by the CIO-DAS1600 as a pacer clock to synchronize A/D conversions.

One full counter, counter 0, is available for counting, pulse generation or frequency measurement.

The output of counter 2 is available to provide external synchronization to the A/D converter or as a programmable rate source.

If you desire additional counters, a 5 channel CIO-CTR05 is available.

CLK Input Freq......10 MHz Max
TTL Loads........ Source 1, Sink 4

OTHER ON-BOARD DAS1600 FUNCTIONS

TRIG LOGIC
10/1 MHz
TMR ENABL
D IN 0

37 D CONN.

8254

C/T 0
D37 #21 — CLK 0
D37 #2 — OUT 0
D37 #24 — GAT 0

C/T 1
CLK 1
OUT 1
GAT 1

C/T 2
CLK 2
D37 #20 — OUT 2
GAT 2
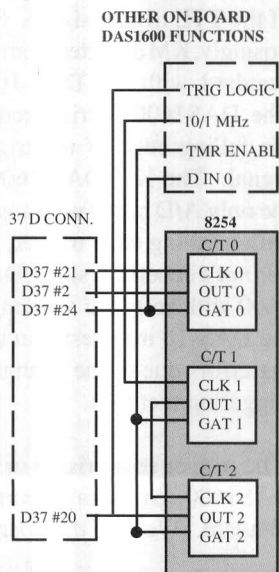
The bipolar/unipolar switch must be set.

Why is the gain and range only half programmable? Only the designer of the KM DAS-1600 knows... By the way, the BIP\UNI switch has been flipped on the KM DAS-1600. It is a UNI/BIP switch on the DAS-16.

The CIO-DAS1600/16 is not made available in a 1601 version because of the gains of 100 and 1000. A 16 bit converter at a gain of 100 resolves each bit to 1.5uV. At that low level we determined the signal to noise made the measurement meaningless. For those with special range requirements, please call the factory to explore other options or custom configurations.

Unipolar / Bipolar Range Select

BIP   UNI
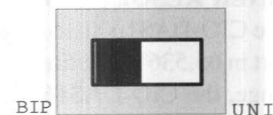
BIP = Bipolar (+/-X) Ranges Selected
UNI = Unipolar (0-X) Ranges Selected

Note: This is opposite from DAS-16

16 / 8 CHANNEL SWITCH

A switch on the CIO-DAS1600 configures the analog inputs as either 8 channels of differential input or 16 channels of single ended input.

16 CHAN 8

DIFFERENTIAL INPUT IS A 3 WIRE ANALOG CONNECTION WHICH IS LESS SUSCEPTIBLE TO NOISE AND GROUND LOOPS.

CH0 HI ———— SIG HI
CH0 LO ———— SIG LO
GND —(V)— SIG GND

SINGLE ENDED INPUT IS A 2 WIRE ANALOG CONNECTION WHICH IS FINE FOR MOST APPLICATIONS.

CH0 HI ———— SIG HI
GND ———— GND

A/D SPECIFICATIONS

Channels	16 SE or 8 Differential
A/D Type	Successive Approx.
Conversion Time	3.3uS (12 bit) 10uS (16 bit)
A/D Convert & Transfer Speed (DMA)	160KHz (12 bit), 100KHz (16 bit)
Accuracy	0.01% +/- 1 LSB
Integral Linearity	+/- 1 LSB
No missing codes guaranteed over temp. range.	
Maximum Overvoltage	+/- 35V Continuous
Input Leakage Current	250 nA Max @ 25ºC
Gain Drift	+/- 25 ppm/Deg C Max
Zero Drift	+/- 10 ppm/Deg C Max

If the DAC 0 reference is supplied on board, the external reference input pin of the 37 pin connector may be converted to a simultaneous sample & hold output sync pulse by installing the jumper labeled SH.

D/A SPECIFICATIONS 12 BIT

Channels	2
D/A Type	Multiplying 4 Quadrant
Conversion Time	30nS to 0.01%
Integral Linearity	+/- 1 LSB
Differential Linearity	+/- 1 LSB
Reference Range	+/- 10V
Output Range	+/- 10V, Reference dependent
Jumper selectable ranges	0-5V, 0-10V, +/-5V, +/-10V
R Out	0.1 Ohm Max
I Out	+/- 5mA Min

connector mounted to a backplate via the BP40-37 cable and connector kit. Once brought to the 37 pin connector, the pin assignments are those of a CIO-DIO24.

SPECIFICATIONS	MIN	MAX
V Input Logic Low	-0.5V	0.8V
V Input Logic High	2.0V	5.0V
Input Load Current	-10uA	10uA
V Output Low	GND	0.45V
Sink Current		2.5mA
V Output High	2.4V	
Source Current		2.5mA
TTL Loads	1 SRC	4 SNK

Pin	Signal		Pin	Signal
19	GND		37	Port A0
18	+5V		36	Port A1
17	GND		35	Port A2
16	+12V		34	Port A3
15	GND		33	Port A4
14	-12V		32	Port A5
13	GND		31	Port A6
12	-5V		30	Port A7
11	GND		29	Port C0
10	Port B0		28	Port C1
9	Port B1		27	Port C2
8	Port B2		26	Port C3
7	Port B3		25	Port C4
6	Port B4		24	Port C5
5	Port B5		23	Port C6
4	Port B6		22	Port C7
3	Port B7		21	PC Bus GND
2	IR Enable		20	PC Bus +5
1	IR Input			

VIEW FROM REAR OF PC

BASE ADDRESS SELECTION

The CIO-DAS1600 is addressed through software at an I/O address set by the switch shown here. The switch selects the first or BASE address. Switches have values in the down position. Values are added.

Address 300H shown

SW	HEX
A9	200
A8	100
A7	80
A6	40
A5	20
A4	10

9 8 7 6 5 4 WAIT EN
↓ ↓ ↑ ↑ ↑ ↑ ↑

WAIT EN Switch shown NOT enabled

A wait state may be implemented by placing the WAIT EN switch in the down position. The KM-DAS1600 has an additional switch for 1/10MHz XTAL rate to the 8255. The CIO-DAS1600 offers the same choice via jumper selection.

DMA LEVEL SELECT

The CIO-DAS1600 can use DMA levels 1 or 3, providing full compatibility with PC/XT/AT/PS30.

1 [▭▬] 3

I/O & CONTROL REGISTER MAP

The CIO-DAS1600 and MetraByte DAS-1600 are 100% software compatible because the I/O registers have identical functions on each board. I/O registers are the locations to which the computer writes and reads commands and data.

To increase functionality and remain compatible with the older CIO-DAS16, the CIO-DAS1600 takes advantage of IBM's choice to decode only I/O addresses 0-3FF (A0-A9). By decoding A10, a bank of 16 additional I/O registers open up for the 8255 control and I/O and for the extended feature control and status

I/O ADDR.	CIO-DAS16 FUNCTION R-W	I/O ADDR.	CIO-DAS16 FUNCTION R - W
BASE + 0	A/D Low Byte - Start A/D	BASE + 8	A/D Status - NA
BASE + 1	A/D High Byte - NA	BASE + 9	Control Settings - Control
BASE + 2	Mux Settings - Mux Scan Control	BASE + A	NA - Counter Source Control
BASE + 3	Digital 4 In - Digital 4 Out	BASE + B	Programmable Gain Set
BASE + 4	NA - D/A0 Low Byte Out	BASE + C	Counter 0 - Counter 0 Load
BASE + 5	NA - D/A0 High Byte Out	BASE + D	Counter 1 - Counter 1 Load
BASE + 6	NA - D/A1 Low Byte Out	BASE + E	Counter 2 - Counter 2 Load
BASE + 7	NA - D/A1 High Byte Out	BASE + F	NA - 8254 Counter Control
	8255 FUNCTION R - W		EXTENDED FEATURES
BASE + 400	Port A In - Port A Out	BASE + 404	Conversions Enable/Disable
BASE + 401	Port B In - Port B Out	BASE + 405	Burst Mode Enable/Disable
BASE + 402	Port C In - Port C Out	BASE + 406	DAS1600 mode Enable/Disable
BASE + 403	NA - 8255 Control	BASE + 407	Status of Extended Features

The CIO-DAS1600

Cloning the DAS-1600 was child's play

FASTER A/D

The A/D used in the Keithley/MetraByte DAS-1600 is the skinny AD774, an 8uS A/D. Using this 8uS A/D and a 2uS sample & hold, the KM DAS-1600 is capable of 10uS conversions or a maximum of 100KHz single channel. In addition to limiting total throughput, the conversion rate sets the 'burst mode' channel to channel skew rate. Burst mode is a much touted feature of the KM DAS-1600. Let us take a closer look at burst mode.

The objective of burst mode is to reduce channel to channel skew (time between samples of each channel). Burst mode can only minimize channel to channel skew relative to the time between scans. For example, at the maximum rate of the board, 100KHz, burst mode is useless because the burst rate of 10uS between samples is equal to the total rate of 10uS per sample. At a low speed like 1KHz, 10uS between samples compares favorably with a rate of 1,000uS between samples in non-burst mode. If you were taking a set of samples from 8 channels, the maximum skew is 80uS (8 * 10uS) and that is 8% of the time between scans (1,000uS). That difference may be important to your analysis. If it is, the CIO-DAS1600/12 is better.

The CIO-DAS1600/12 uses a 3.3uS A/D with integrated sample & hold, giving the CIO-DAS1600/12 a maximum conversion rate of 3.3uS or 330KHZ. The channel to channel skew in burst mode drops from 10uS (KM DAS-1600) to 3.3uS; one third that of the KM DAS-1600.

FIFO BUFFER = FASTER A/D THROUGHPUT

The CIO-DAS1600/12 has a 1K sample FIFO buffer. The FIFO buffer allows the board to convert data at rates greater than the maximum synchronous bus transfer rate. The data is converted synchronously on the CIO-DAS1600/12 and placed in the FIFO buffer. The data is then transferred asynchronously out of the FIFO. DMA transfers are much faster with a FIFO buffer on the A/D board. Because of the FIFO buffer, the CIO-DAS1600/12 will run at 160KHz using DMA transfers, a 60% FASTER A/D DMA transfer throughput. That includes any new or old MetraByte or ComputerBoards drivers or third party software!

The FIFO buffer has other benefits, specifically it improves burst mode performance and allows the CIO-DAS1600 to work under Windows at much higher rates that the KM DAS-1600.

DT-CONNECT

The DT-Connect transfers data fully independent of the PC bus. On the DT-Connect you can run the CIO-DAS1600/12 at 250KHz multi-channel or 330KHz single channel. Because you need a place to put that data we have introduced the MEGA-FIFO, a memory board with DT-Connect. It can be populated with sixteen 1MB, 4MB or 16MB SIMMs for 8Mega Samples, 32MS or 128MS of memory. Advanced array processors which employ DT-Connect are ready for the CIO-DAS1600 as well.

HIGHER RESOLUTION CIO-DAS1600/16

The CIO-DAS1600/16 uses a 16 bit converter. The resolution of the A/D improves by a factor of 16 from 1 part in 4,096 to 1 part in 65,536. The higher resolution converter has conversion rate of 10uS resulting in a maximum speed of 100KHz for the CIO-DAS1600/16, but that just means the speed is equal to the KM DAS-1600 in exachange for 16 times greater resolution!

THE BOTTOM LINE

The CIO-DAS1600/12 is 34% less expensive, i s 60% faster using conventional software, has 3 times better burst mode performance, is 150% faster using a MEGA-FIFO and more Windows ready (the 1K buffer) than they are. The CIO-DAS1600/16 has **16 times** more resolution.
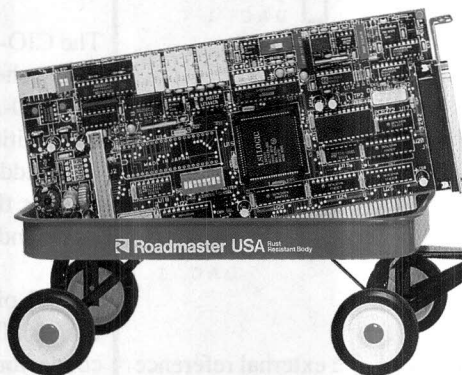
SIMULTANEOUS SAMPLE & HOLD

Capture 16 channels simultaneously with less than 50 nSec of aperture uncertainty at 100KHz. The CIO-SSH16 simultaneous sample & hold accessory expands the CIO-DAS1600's 16 single ended, multiplexed inputs into 16 fully differential inputs with individual, switch selectable gains of up to 800 on every channel. The 16 sample & holds are triggered by the CIO-DAS1600 once per scan as fast as the CIO-DAS1600 will go.

The CIO-SSH16 is triggered by a CIO-DAS1600 track & hold pulse which is generated by the CIO-DAS1600 on every scan. No software modifications are required to realize the benefits of simultaneous sample & hold. Just drop a CIO-DAS1600 and CIO-SSH16
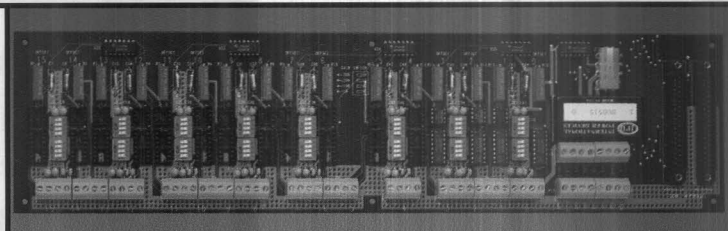
into your existing DAS-1600 application. Fire up the software you've been using all along and start collecting data from simultaneous samples.

An excellent addition to audio, vibration or other multi-channel spectrum analysis applications.

SCREW TERMINAL ACCESSORIES

Screw terminal boards accept 12-22 AWG wire or spade lugs. The CIO-TERMINAL provides prototype area, pull up resistor, filter and divider circuitry you can populate.

The CIO-SPADE50 has tough spade lugs in a 16" X 4" form factor for easy NEMA cabinet or rack mounting. A good termination panel for industrial applications.

The CIO-MINI37 is the most compact and economical terminal board available. Forty screw terminals provide access to all 37 CIO-DAS1600 signals plus 3 spares. Two small proto areas are just enough for an op-amp or a few passives.
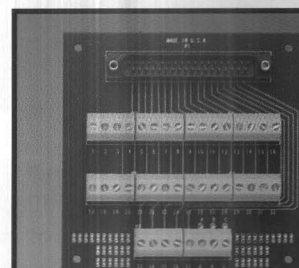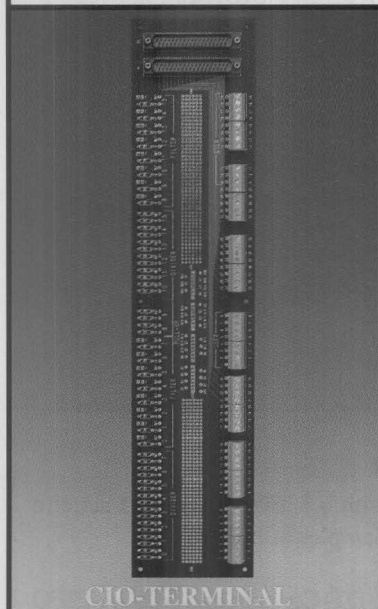
CIO-TERMINAL   CIO-SPADE50   CIO-MINI37
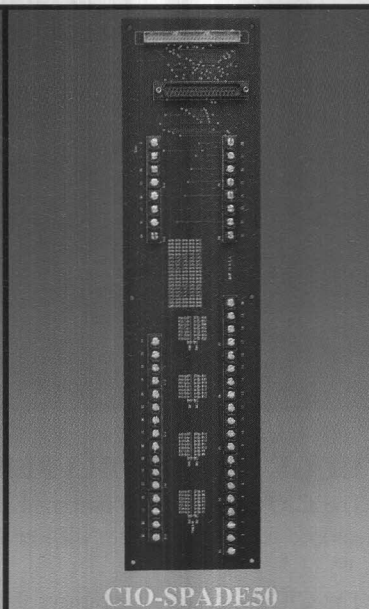
CABLES & CONNECTORS

Highest quality cables and connectors of all lengths are available from stock. The CIO-DAS1600 has male 37 D connectors as do the accessory and screw terminal boards. The cables which mate A/D board to screw terminal are terminated with 37 D female connectors at each end. Shielded cables of 5 and 10 feet and ribbon cables of all lengths are available.

C37FFS-5 SHIELDED
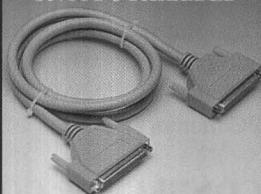
The BP40-37 brings signals from internal connectors to the rear of the PC, where a standard cable joins the BP40-37 to accessory boards. The BP40-37 is shown here with a CIO-DAS08.

BP40--37

C37FF-2 RIBBON
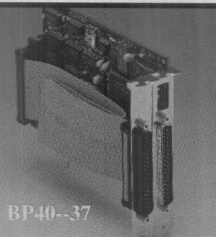
ORDERING GUIDE

CIO-DAS1600/12 comes in two gain ranges.

|	
16 Channel, 12 bit, gains of 1,10,100,1000	CIO-DAS1601/12
16 Channel, 12 bit, gains of 1,2,4,8	CIO-DAS1602/12
16 Channel, 16 bit, gains of 1,2,4,8	CIO-DAS1602/16
Universal Driver Language Programming Library	UNIV-DRVR
Sample & Hold Accessory	
16 Ch. S&H Diff. Amp accessory board, 4 Ch. installed.	CIO-SSH16
Additional S&H + Amps installed. Up to 12 additional.	CIO-SSH-AMP
Screw Terminal Boards	
16" X 4" all signals from one 37 D plus proto area.	CIO-TERMINAL
4" X 4" all signals from one 37 D connector.	CIO-MINI37
16" X 4" all signals from one 37D, Spade Lug Terminals.	CIO-SPADE50
Cables	
2 foot ribbon cable, 37 conductor, female connectors.	C37FF-2
'N' foot ribbon cable, 37 conductor, female connectors.	C37FF-N
5 foot shielded cable, molded female connectors, 37 cond.	C37FFS-5
10 foot shielded cable, molded female connectors, 37 cond.	C37FFS-10

THIRD PARTY SOFTWARE SUPPORT

VIS SIM DACQ	DRIVERLinx
Universal Driver	LabTech Notebook
CTOOLS	Snap Master
TTOOLS	Streamer
ASYST	Unkelscope
Control CB	ViewDAC
DADISP	

UNIVERSAL DRIVER - Programming Support

To program you CIO-DAS1600, you will need to purchase a programming language library, such as Universal Driver, C-TOOLS or T-TOOLS. The CIO-DAS1600 is supplied with programs for installation, calibration and test. It is up to you to choose programming support or an application package from those available.

CIO-DAS16/M1
1MHz 8 Channel 12 Bit Analog Input, Programmable Gain Queue
24 Digital I/O & Three 16 Bit Counter/Timers

DT CONNECT
BOARD-TO-BOARD
HIGH SPEED DATA
TRANSFER

DC/DC +/-15V
ALL ANALOG
POWER

1024 SAMPLE
FIFO BUFFER

1Mhz, 0.8uS A/D

PROGRAMMABLE GAIN QUEUE (256)
+/-10V, +/-5V, +/-2.5V
+/-1.25V, +/-0.625V
0-10V, 0-5V, 0-2.5V, 0-1.25V

37 PIN CONNECTOR
DAS-16 COMPATIBLE

24 DIGITAL I/O & 3 COUNTER/
TIMERS

AT BUS REP INSW
HIGH SPEED BLOCK
TRANSFER
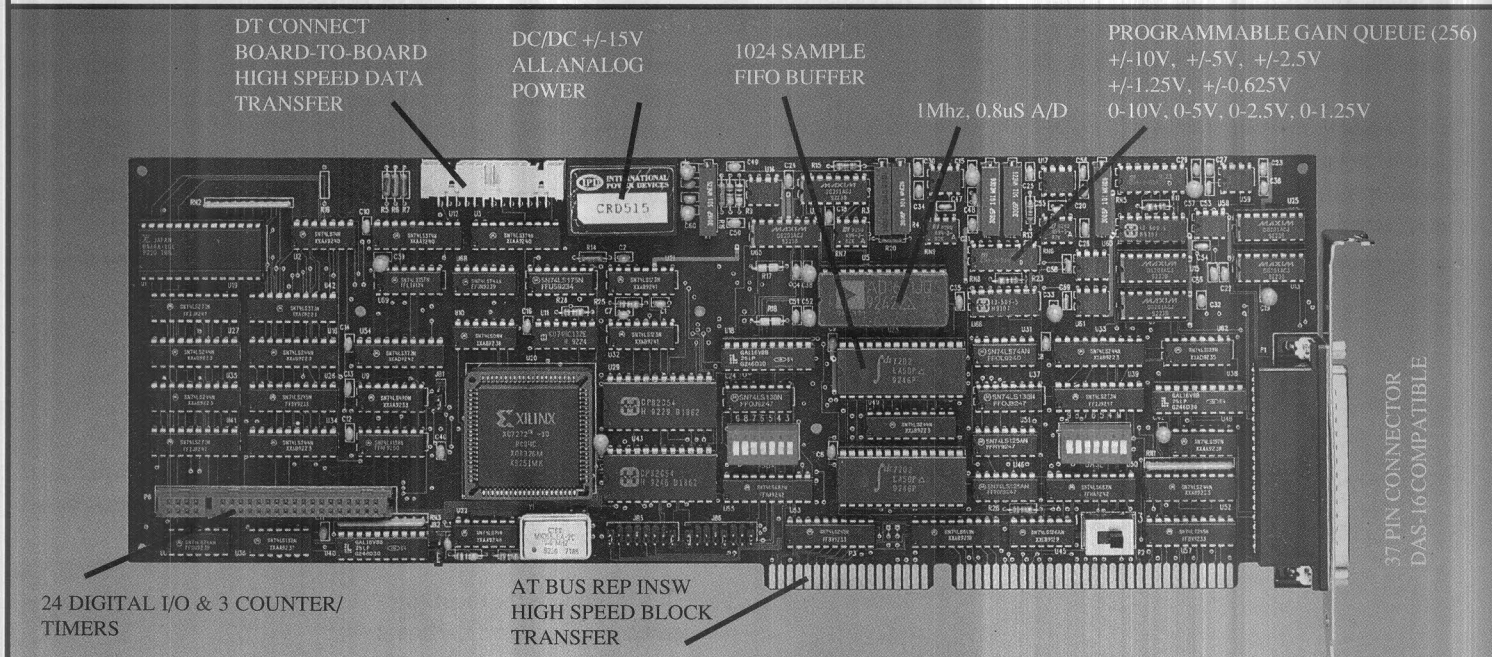
1 MHz DAS16/M1

The CIO-DAS16/M1 multifunction analog and digital I/O board is the highest speed variation of the traditional DAS-16 architecture. The extra features of this newest DAS16 are:

* Blazing fast analog input of 1MHz continuous to MEGA-FIFO with sample size limited only by the size of memory on the MEGA-FIFO board.

* Pre-trigger and Post-trigger buffers of unlimited size managed by the hardware and software provide a seamless event driven sample set.

* Programmable 256 step channel/gain queue.

* DT-CONNECT interface for high speed direct transfer of analog data to MEGA-FIFO, array processors and other accessories.

* 24 digital I/O lines and three 16 bit counters, exactly like a CIO-DIO24/CTR3. An 82C55 digital I/O chip and an 82C54 counter/timer provide an array of interfacing options.

LOW COST - EXTRA FEATURES

The CIO-DAS16/M1 is one of the lowest cost megahertz A/D boards available. Compared with other high speed A/D boards the CIO-DAS16/M1 is less than half the price. By employing advanced features like DT-Connect, the CIO-MEGAFIFO and CIO-DAS16/M1 will out sample any other board we know of.

HUGE SAMPLE BUFFER

The CIO-DAS16/M1 combined with a MEGA-FIFO can acquire sample sets of up to 128 Million Samples at full speed!

The CIO-DAS16/M1 employs the DT-Connect and MEGA-FIFO sample buffer board to acquire huge sample sets completely independent of PC bus rates or other simultaneous processes.
High speeds and large sample sets are also possible direct to PC bus and PC memory because the CIO-DAS16/M1 uses a FIFO buffer and the REP-INSW command to transfer blocks at high speed into PC memory

CONNECTOR COMPATIBLE

The CIO-DAS16/M1 is connector compatible with the older, original DAS-16. The control registers are very similar to the CIO-DAS16/330i so adapting low-level drivers to the CIO-DAS16/M1 is a snap. Use the Universal Driver language driver software and programs written for the CIO-DAS16/M1 will run other DAS-16 family boards as well.

FREE STREAMING SOFTWARE

Streaming high speed samples to memory, RAM disk or hard disk is easy with the CIO-DAS16/M1's advanced architecture. In fact it is so easy we include free streaming software with every CIO-DAS16/M1. A STREAM.EXE program will acquire data to the file of your choice *and* the Universal Driver includes modes for streaming data to files under program control.

Call for Friendly Technical Assistance - (508) 261-1123

ANALOG INPUTS

The analog input section of the CIO-DAS16/M1 has been designed for high speed, flexibility and accuracy in a number of configurations and ranges. The analog signals are brought on board by a standard 37 pin D connector directly to balanced multiplexors. The multiplexors are configured as 8 channels of differential input. Differential inputs can reject noise and ground loops (common mode voltages).

Signals are amplified by a programmable gain amplifier prior to conversion by the A/D converter. The possible gains and ranges and associated codes are shown in the table to the right.

An integral sample & hold captures the signal which is then converted by the A/D converter. The 12 bit A/D converter provides a resolution of 1 in 4095 parts of full scale.

The speed of data gathering may vary from less than 1Hz to 1MHz. Acquisition speed is dependent on the method of triggering and data transfer.

METHOD	MAX A/D Speed
DT-Connect to MEGA-FIFO	1MHz
REP INSW to PC Memory	330KHz
Polled by software	4KHz-20KHz
Interrupt Service Routine (no REP INSW)	4KHz - 20KHz

DMA IS DEAD!   The REP INSW story.

REP INSW (Repeat Input String) is a 286/386/486 class CPU instruction which allows the PC to transfer large amounts of data using one instruction. The data is transferred at the maximum rate allowed by the bus. On a typical 286 AT, this rate is 2Mbyte/sec or 1 sample every microsecond.

In order to employ REP INSW the A/D board must have a FIFO buffer to accumulate sample data. The CIO-DAS16/M1 has a 1024 sample buffer. When it is half full (512 samples), an interrupt generated by the DAS16/M1 starts an interrupt service routine which executes the instruction REP INSW transfers the data to PC memory and empties the FIFO buffer.

The data is transferred completely in the background and no unreasonable demands are placed on the PC's resources. For example, screen updates need not be suspended!

A/D SPECIFICATIONS   12 BIT

Channels	8 Differential
A/D Type	Subranging Flash AD1671
Conversion Time	0.8uS
A/D Convert & Transfer Speed	
Out DT-Connect	1MHz
REP-INSW to PC Memory	800KHz
Paced Interrupt Service Routine	20KHz
Accuracy	0.01% +/- 1 LSB
Integral Linearity	+/- 1 LSB
No missing codes guaranteed over temp. range.	
Maximum Overvoltage	+/- 35V Continuous
Input Leakage Current	250 nA Max @ 25°C
Gain Drift	+/- 35 ppm/Deg C Max
Zero Drift	+/- 25 ppm/Deg C Max

GAIN & RANGE PROGRAMMING

No need to set switches to select an analog input range. The analog input range is fully programmable. A programmable gain queue controls both the unipolar/bipolar setting and the amplification of the analog input signal.

The gain/range control byte is located at BASE + 11:

D7	D6	D5	D4	D3	D2	D1	D0
Range	U/B	G1	G0	X	Ch2	Ch1	Ch0

CHANNEL: The channel is set by bits Ch3-Ch0. Valid values are 0-7 for 8 channel, differential mode. For example, Ch2 = 1, Ch1 = 0, Ch0 = 0, then channel 4 is selected.

RANGE = The A/D chip input range, either 10V full scale or 20V full scale. 0 = 10V, 1 = 20V.

U/B = Unipolar or Bipolar ranges. 0 = Bipolar, 1 = Unipolar.

G1 G0 = the gain of the input amplifier. 0,0 = X1. 0,1 = X2. 1,0 = X4. 1,1 = X8.

Input Ranges

+/- 10V	+/- 5V	+/- 2.5V	+/- 1.25V	+/- 0.625V
0 to 10V	0 to 5 V	0 to 2.5V	0 to 1.25V	

GAIN QUEUE PROGRAMMING

The channel/gain queue may be loaded with a sequence of between 1 and 256 channel+gain (CGQ) codes. When an analog input run is started, data will be acquired from the channels in the order specified by the CGQ. The programmable gain amplifier will be switched to the appropriate gain for the channel selected.

After the CGQ is loaded with a sequence of up to 256 different channel/gain combinations, all A/D channel & gain control are derived from the CGQ. The CGQ is automatically restarted when the last CGQ entry written is reached. For example, if you load 5 CGQ steps into the CGQ, the 1st, 6th, 11th... A/D sample in a run is controlled by the 1st entry in the CGQ. In this manner, large sample runs may be precisely controlled.

HIGH-SPEED CONTROL REGISTER

The DAS16/M1 has a special control register. This register controls word/byte transfers, enables the DT-Connect interface, pre/post trigger enable and FIFO status.

D7	D6	D5	D4	D3	D2	D1	D0
DTC	PTE	F/Q	X	X	X	X	X

DTC = DT Connect enable. 0 = disable. 1 = enable a DT Connect "Master Out". Data is available as each A/D conversion is completed. The slave must reply before the next conversion is complete.

PTE = Post Trigger Enable. 0 = disable. 1 = Enable the post-trigger counter to demarcate the boundary between pre- and post- trigger data.

F/Q = FIFO buffer status /CGQ Active. Read: 1 = Overrun. A logical OR of the fault conditions FIFO Full, DTC overrun and DMA overrun. 0 = no fault.

I/O & CONTROL REGISTER MAP

The CIO-DAS16/M1 uses 16 I/O addresses for registers which control triggering, A/D sample rate, channel/gain queue and transfer mode. An additional 8 registers control digital and counter I/O.

I/O ADDR.	FUNCTION R/W	I/O ADDR.	FUNCTION R -/W
BASE + 0	A/D Low Byte / Start A/D	BASE + 8	Q Counter 0 / Load
BASE + 1	A/D High Byte / NA	BASE + 9	Q Counter 1 / Load
BASE + 2	Counter Source Control	BASE + A	Q Counter 2 / Load
BASE + 3	Digital 4 In / Digital 4 Out	BASE + B	NA / 8254 Control
BASE + 4	A/D Status / IR Clr	BASE + C	Counter 0 / Counter 0 Load
BASE + 5	Control Settings / Control	BASE + D	Counter 1 / Counter 1 Load
BASE + 6	CGQ Address	BASE + E	Counter 2 / Counter 2 Load
BASE + 7	Gain & Range Queue	BASE + F	NA / 8254 Counter Control

I/O ADDR.	24 DIGITAL I/O & 3 COUNTERS		
BASE + 400	PORT A , 82C55	BASE + 404	CTR 0, 82C54
BASE + 401	PORT B, 82C55	BASE + 405	CTR 1, 82C54
BASE + 402	PORT C, 82C55	BASE + 406	CTR 2, 82C54
BASE + 403	82C55 CONTROL	BASE + 407	82C54 CONTROL

STANDARD DAS16 ANALOG CONNECTOR

The 37 pin D connector on the CIO-DAS16/M1 is identical to that of the CIO-DAS16.

Of course, the pins which carry analog output signals on the CIO-DAS16 are no-connect (NC) on the DAS16/M1 board. These pins are left floating rather than tied to ground or some other signal. That way your existing cables and connections will be compatible.

Because of Computer Boards' strict adherence to standards, accessory boards, cables and all of your existing hook-ups are 100% compatible with the DAS16 connector in the 8 channel differential mode.
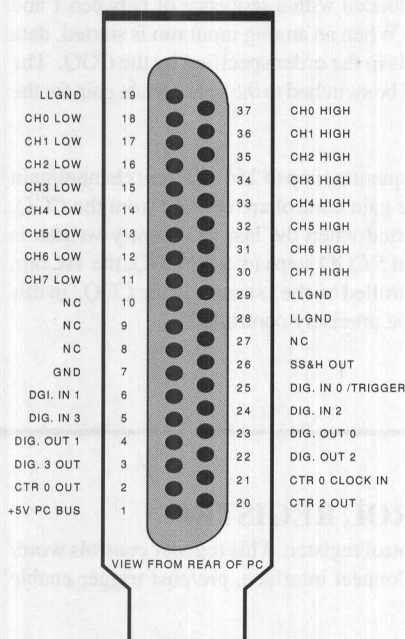
LLGND	19		
CH0 LOW	18	37	CH0 HIGH
CH1 LOW	17	36	CH1 HIGH
CH2 LOW	16	35	CH2 HIGH
CH3 LOW	15	34	CH3 HIGH
CH4 LOW	14	33	CH4 HIGH
CH5 LOW	13	32	CH5 HIGH
CH6 LOW	12	31	CH6 HIGH
CH7 LOW	11	30	CH7 HIGH
NC	10	29	LLGND
NC	9	28	LLGND
NC	8	27	N C
GND	7	26	SS&H OUT
DIG. IN 1	6	25	DIG. IN 0 /TRIGGER
DIG. IN 3	5	24	DIG. IN 2
DIG. OUT 1	4	23	DIG. OUT 0
DIG. 3 OUT	3	22	DIG. OUT 2
CTR 0 OUT	2	21	CTR 0 CLOCK IN
+5V PC BUS	1	20	CTR 2 OUT

VIEW FROM REAR OF PC

BASE ADDRESS

The base address switch controls the block of I/O addresses occupied by the CIO-DAS16/M1. The CIO-DAS16/M1 occupies 16 addresses. The 24 digital I/O and 3 counters use 8 addresses in the PC unused address space above 700 Hex.

Address 300H shown

SW	HEX
A9	200
A8	100
A7	80
A6	40
A5	20
A4	10
A3	8

9 8 7 6 5 4 3
↓ ↓ ↑ ↑ ↑ ↑ ↑
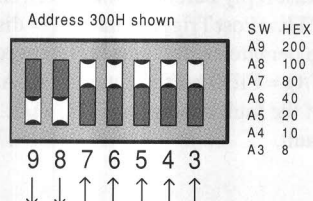
24 DIGITAL & 3 COUNTER FEATURES
24 Line of TTL Digital I/O (8255)
3 Sixteen Bit Counters (8254)
10 MHz Oscillator on board
Internal Jumpers for Counter Chaining

For applications which require multiple digital inputs and outputs, or counters, a second connector at the rear of the board provides access to one 82C55 DIO chip and one 82C55 counter. The configuration of the connector is identical to the CIO-DIO24/CTR3. Digital I/O points may be used to sense contact closures aor control relays

Three, sixteen bit counters allow you to measure frequency or count events like the number of times a door opens, or items passing on a conveyor belt. The 8254 counter is easy to program and use from any language.

Please look at the connector diagram which shows the counter's input, gate and output pin assignments. If you would like to learn more about the 8254 counter, Intel publishes a data book with complete programming and application information.

DIGITAL & COUNTER SPECIFICATIONS

# TTL Digital I/O	24 as 3, 8 bit ports
Logic low level	-0.5 to 0.8V Max
Logic high level	2.0 to 5.0V Max
Input current	+/- 10 uA
Output low sink current	1.7 mA @ 0.45V
Output high source current	-200 uA @ 2.4V
8254 COUNTER	
Type - Fully programmable	16 Bit Down Counter
Control - TTL Level	Gated Input
Max Input Frequency	10MHz - On board Osc

DIGITAL I/O CONNECTOR

CTR3	DIO24				
CTR 0	GND	19			
GATE 0	+5V	18	37	Port A0	
OUT 0	GND	17	36	Port A1	
CTR 1	+12V	16	35	Port A2	
GATE 1	GND	15	34	Port A3	
OUT 1	-12V	14	33	Port A4	
CTR 2	GND	13	32	Port A5	
GATE 2	-5V	12	31	Port A6	
OUT 2	GND	11	30	Port A7	
	Port B0	10	29	Port C0	
	Port B1	9	28	Port C1	
	Port B2	8	27	Port C2	
	Port B3	7	26	Port C3	
	Port B4	6	25	Port C4	
	Port B5	5	24	Port C5	
	Port B6	4	23	Port C6	
	Port B7	3	22	Port C7	
	IR Enable	2	21	PC Bus GND	
	IR Input	1	20	PC Bus +5	

VIEW FROM REAR OF PC

The connector carries 24 digital I/O lines plus PC power, or for the CTR3 board, the counter inputs and outputs.

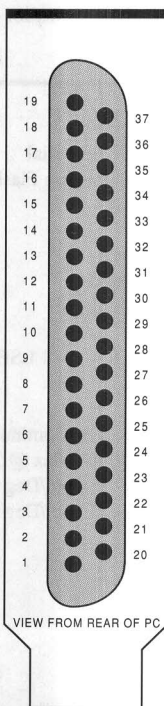The 8255 has 24 I/O lines. The chip is configured as 3 ports. Two ports, A & B, are 8 bits wide. Port C may be an 8 bit port or two 4 bit ports.

Individual ports may be configured as Input or Output and are written to and read from as a unit.

Counter inputs, gates and outputs may be controlled or chained at the connector, or inboard on a counter chaining jumper.

Call for Friendly Technical Assistance - (508) 261-1123

UNIVERSAL DRIVER
C, Pascal, & BASIC Language Libraries

Programmers will appreciate the easy to use programming library, The Universal Driver. It is universal in two ways. Universal functional syntax for all boards means that the program does not change no matter which A/D board you use as long as boards share common features. Universal language syntax means that the code is easily understood in all the languages supported because the syntax is constant across all languages.

The full range of capability for the CIO-DAS16/M1 is supported and new language are being added. Please see the data sheet for the Universal Driver.

SCIENCE & ENGINEERING TOOLS
C, Pascal, & BASIC Language Libraries

Science and engineering tools are a collection of routines you use like tools to save time solving programming problems, like adding graphics or analysis to your programs.

Solve Regression & Simultaneous equations. Do FFTs, matrix math or curve fitting. Display the results with charting graphics or 3 D plotting routines.

Please see the data sheet for Science & Engineering Tools in ComputerBoards Data Acquisition Software catalog.

DT Connect™ High Speed Board-to-Board Interface

High speed transfers of data from the data acquisition board to special function boards, such as array processors or large sample buffers are best handled by dedicated interboard interfaces. Several such interfaces have been proposed by data acquisition vendors and one, DT-Connect has emerged as a standard.

Shown here is a high speed array processor connected to the CIO-DAS16/M1. A number of vendors subscribe to the DT-Connect standard for interboard communication because large blocks of data may be transferred at rates up to 10,000,000 Bytes/Sec independent of the PC bus.
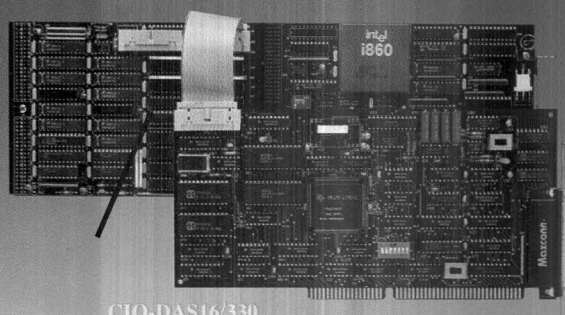
CIO-DAS16/330

MEGA-FIFO HUGE SAMPLE BUFFER

Some 1MHz plus A/D boards come with a 1Mega Sample (MS) buffer on board, others can hold as much as 4MS. Only the CIO-DAS16/M1 can store up to 128 million samples completely independent of PC memory. Imagine 2MS, 8MS, 32MS or 128MS - full speed - fully independent!

Because the MEGA-FIFO gets data from the A/D board over the DT-Connect interface and not through the PC bus, transfer speeds are unaffected by PC overhead. Likewise, the A/D system does not slow down the PC which may be number crunching, painting graphics or moving data across networks.

Populate the MEGA-FIFO with Standard SIMMs

The MEGA-FIFO is sold without memory because you may have older 256K or 1M SIMMs stored in a drawer somewhere; the same as you would use in a PC. If you do not, you can buy standard 80nS SIMMs from a number of sources and the price is always falling. The MEGA-FIFO holds 16 SIMMs. Populate as follows with 256K SIMMs for 2MS, 1MBs for 8MS, 4MBs for 32MS or 16MBs for 128 Million Samples of A/D buffer!
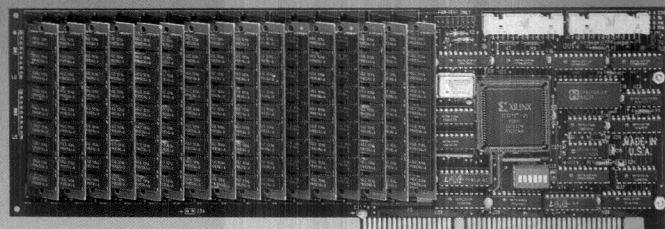
ORDERING GUIDE

1MHz Max Analog Input for AT/386 bus with 1 iSBX expansion connector.	CIO-DAS16/M1
128 MEGA Sample Buffer Board Sold without memory - Takes 256K, 1M, 4M, 16M SIMMs	MEGA-FIFO
Universal Driver Programmaing Language Library	UNIV-DRVR
Screw Terminal Boards	
16" X 4" all signals from one 37 D plus proto area.	CIO-TERMINAL
4" X 4" all signals from one 37 D connector.	CIO-MINI37
16" X 4" all signals from one 37D, Spade Lug Terminals.	CIO-SPADE50
Cables	
40 Pin connector to D37 backplate	BP40-37
2 foot ribbon cable, 37 conductor, female connectors.	C37FF-2
'N' foot ribbon cable, 37 conductor, female connectors.	C37FF-N
5 foot shielded cable, molded female connectors, 37 cond.	C37FFS-5
10 foot shielded cable, molded female connectors, 37 cond.	C37FFS-10
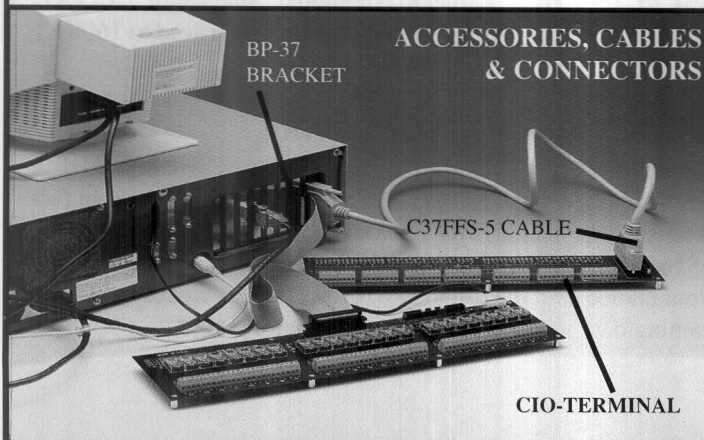
ACCESSORIES, CABLES & CONNECTORS

BP-37 BRACKET

C37FFS-5 CABLE

CIO-TERMINAL

CIO-DAS16/330i

330KHz 16 Channel 12 Bit Analog Input, Programmable Gain Queue & 2 iSBX Expansion Connectors

DAS-16 REGISTER COMPATIBLE WORKS WITH OLD OR NEW SOFTWARE

DT CONNECT BOARD-TO-BOARD HIGH SPEED DATA TRANSFER

1024 SAMPLE FIFO BUFFER

DC/DC +/-15V ALL ANALOG POWER

330KHz, 3uS A/D

PROGRAMMABLE GAIN QUEUE (256)
+/-10V, +/-5V, +/-2.5V
+/-1.25V, +/-0.625V
0-10V, 0-5V, 0-2.5V, 0-1.25V

8 DIFFERENTIAL 16 SINGLE ENDED

37 PIN CONNECTOR DAS-16 COMPATIBLE

iSBX EXPANSION BUS CONNECTORS - CHOOSE FROM
4 CHANNEL ANALOG OUTPUT (330KHz)
DIGITAL OUTPUT (500KHz)
FIVE 16 BIT COUNTERS
24 BITS HIGH DRIVE DIGITAL I/O

AT BUS REP INSW HIGH SPEED BLOCK TRANSFER

BASE ADDRESS SWITCH

DMA 1 OR 3 SELECT

DAS-16 PLUS ADDED FEATURES

The CIO-DAS16/330i multifunction analog and digital I/O board is designed to be a modern improvement upon the traditional DAS-16 architecture with higher speed and additional features, all at a lower cost.

* Blazing fast analog input of 330KHz continuous to memory or RAM disk with sample size limited only by the size of memory or RAM disk.

* Pre-trigger and Post-trigger buffers of unlimited size managed by the hardware and software provide a seamless event driven sample set.

* Programmable 256 step channel/gain queue.

* DT-CONNECT interface for high speed direct transfer of analog data to array processors and other accessories.

* Two complete iSBX expansion connectors allow the addition of digital I/O, counters, analog output, serial I/O and more. Add a DIO24H or CTR05 directly to the DAS16/330i.

BEYOND THE 64K BARRIER

The CIO-DAS16/330i acquires sample sets of greater than 32K samples (64KB of memory) by employing advanced instructions; just as do LAN and hard disk controllers. You cannot imagine a LAN unable to transfer data files of greater than 64K, can you? Although tran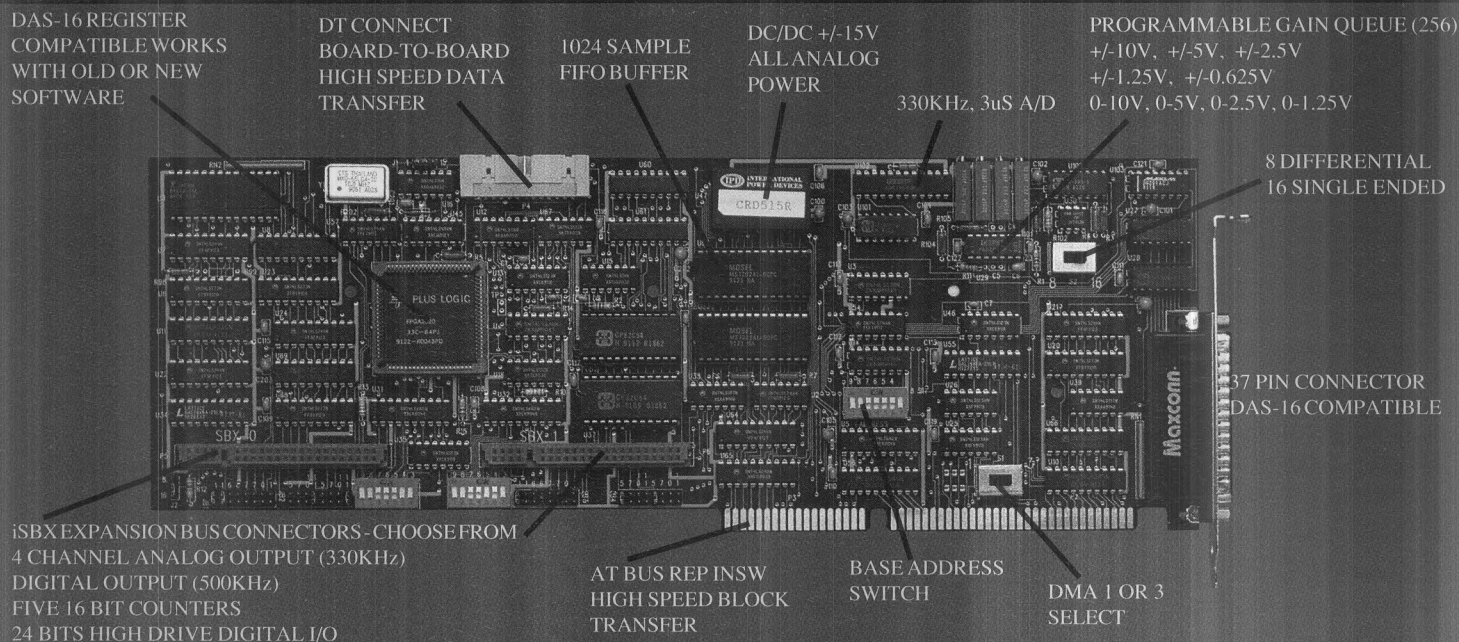sfers to array variables are still limited to 64KB, samples may be streamed to data files far in excess of 64K using the free streaming software supplied with each board!

TWO MODES

On power up, the CIO-DAS16/330i is software compatible with the older, original architecture shared by the DAS-16. In this mode all old DAS-16 type software runs and the new advanced registers are invisible to the PC bus. Set one special control bit and supercharge the CIO-DAS16/330i! In special mode, a new set of registers open up that allow A/D transfers up to 330KHz, pre/post trigger buffers and access to the DT-Connect feature for high speed transfers to array processors.

160KHz FROM OLD SOFTWARE

Even old software runs better with the CIO-DAS16/330i. Replace the DAS-16 you currently use and suddenly the max acquisition rate jumps to 160KHz. Labtech Notebook, Snap-Shot, ASYST, CTOOLS; all of these software packages are improved to 160KHz by the addition of a CIO-DAS16/330i!

FREE STREAMING SOFTWARE

Streaming high speed samples to memory, RAM disk or hard disk is easy with the CIO-DAS16/330i's advanced architecture. In fact it is so easy we include free streaming software with every CIO-DAS16/330. A STREAM.EXE program will acquire data to the file of your choice *and* the supplied BASIC CALL includes modes for streaming data to files under program control.

Call for Friendly Technical Assistance - (508) 261-1123

ANALOG INPUTS

The analog input section of the CIO-DAS16/330i has been designed for high speed, flexibility and accuracy in a number of configurations and ranges. The analog signals are brought on board by a standard 37 pin D connector directly to two multiplexors. The two multiplexors may be configured as 16 channels of single ended input or 8 channels of differential input. Differential inputs can reject noise and ground loops (common mode voltages) but require a 3 wire hookup as opposed to 2. Please see the diagram to the right.

Signals are amplified by a programmable gain amplifier prior to conversion by the A/D converter. The possible gains and ranges and associated codes are shown in the table to the right.

An integral sample & hold captures the signal which is then converted by the A/D converter. The 12 bit A/D converter provides a resolution of 1 in 4095 parts of full scale.

The speed of data gathering may vary from less than 1Hz to 330KHz. Acquisition speed is dependent on the method of triggering and data transfer.

METHOD	MAX A/D Speed
Polled by software	4KHz-20KHz
Interrupt Service Routine (no REP INSW)	4KHz - 20KHz
DMA	160KHz
REP INSW	330KHz

Software supporting each method is supplied free with every board.

DMA LEVEL SELECT

The CIO-DAS16/330i can use DMA levels 1 or 3, providing full compatibility with old-style DMA transfer software. Of course speed is vastly improved; to 160KHz

1 [switch] **3**

DMA IS DEAD!   The REP INSW story.

REP INSW (Repeat Input String) is a 286/386/486 class CPU instruction which allows the PC to transfer large amounts of data using one instruction. The data is transferred at the maximum rate allowed by the bus. On a typical 286 AT, this rate is 2Mbyte/sec or 1 sample every microsecond.

In order to employ REP INSW the A/D board must have a FIFO buffer to accumulate sample data. The CIO-DAS16/330i has a 1024 sample buffer. When it is half full (512 samples), an interrupt generated by the DAS16/330i starts an interrupt service routine which executes the instruction REP INSW transfers the data to PC memory and empties the FIFO buffer.

The data is transferred completely in the background and no unreasonable demands are placed on the PC's resources. For example, screen updates need not be suspended!
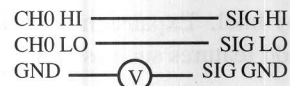
A/D SPECIFICATIONS   12 BIT

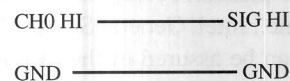|	
Channels	16 SE or 8 Differential
A/D Type	Successive Approx. ADS 7800
Conversion Time	3 uS
A/D Convert & Transfer Speed	330KHz
Accuracy	0.01% +/- 1 LSB
Integral Linearity	+/- 1 LSB
No missing codes guaranteed over temp. range.	
Maximum Overvoltage	+/- 35V Continuous
Input Leakage Current	250 nA Max @ 25ºC
Gain Drift	+/- 25 ppm/Deg C Max
Zero Drift	+/- 10 ppm/Deg C Max

8 / 16 CHANNEL SWITCH

A switch on the CIO-DAS16/330i configures the analog inputs as either 8 channels of differential input or 16 channels of single ended input.

8 [switch] **16**
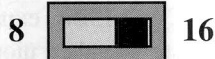
DIFFERENTIAL INPUT IS A 3 WIRE ANALOG CONNECTION WHICH IS LESS SUSCEPTIBLE TO NOISE AND GROUND LOOPS.

SINGLE ENDED INPUT IS A 2 WIRE ANALOG CONNECTION WHICH IS FINE FOR MOST APPLICATIONS.

CH0 HI ——————— SIG HI
CH0 LO ——————— SIG LO
GND ———(V)——— SIG GND

CH0 HI ——————— SIG HI

GND ——————— GND

GAIN & RANGE PROGRAMMING

No need to set switches to select an analog input range. The analog input range is fully programmable. A single write to Base + 11 controls both the unipolar/bipolar setting and the amplification of the analog input signal.

The gain register, located at the board's Base + 11 address, is an eight bit register. The lower four bits control the gain and range.

D7	D6	D5	D4	D3	D2	D1	D0
X	X	X	X	Range	U/B	G1	G0

RANGE = The A/D chip input range, either 10V full scale or 20V full scale. 0 = 10V, 1 = 20V.
U/B = Unipolar or Bipolar ranges. 0 = Bipolar, 1 = Unipolar.
G1 G0 = the gain of the input amplifier. 0,0 = X1. 0,1 = X2.
1,0 = X4. 1,1 = X8.

This is a chart of all four bits assembled into a control nibble.

Range	U/B	G1	G0	Input Range
1	0	0	0	+/- 10V
0	0	0	0	+/- 5V
0	0	0	1	+/- 2.5V
0	0	1	0	+/- 1.25V
0	0	1	1	+/- 0.625V
0	1	0	0	0 to 10V
0	1	0	1	0 to 5 V
0	1	1	0	0 to 2.5V
0	1	1	1	0 to 1.25V

GAIN QUEUE PROGRAMMING

A 256 Byte channel+gain queue may be activated by writing to the QUEUE control bit in the Base+11 register. When the queue is activated, it may be loaded with a sequence of 256 channel+gain (CGQ) codes. When an analog input run is started, data will be acquired from the channels in the order specified by the CGQ. The programmable gain amplifier will be switched to the appropriate gain for the channel selected.

Activate the CGQ by writing to bit 5 of the BASE+11 (DAS-16G Gain) register. Once activated, channels and gains are controlled by the CGQ.

Write to the CGQ:
        BASE + 22 = 0-255, sequence # in CGQ.
        BASE + 24 = A/D Channel + A/D Gain

After the CGQ is loaded with a sequence of up to 256 different channel/gain combinations, all A/D channel & gain control are derived from the CGQ. The CGQ is automatically restarted when the last CGQ entry written is reached. For example, if you load 5 CGQ steps into the CGQ, the 1st, 6th, 11th... A/D sample in a run is controlled by the 1st entry in the CGQ. In this manner, large sample runs may be precisely controlled.

# iSBX EXPANSION CONNECTORS - ADD DIGITAL, COUNTERS, D/A

CUSTOMIZE YOUR DAS16/330i

The "i" in CIO-DAS16/330i stands for TWO iSBX expansion connectors. The iSBX interface is an industry standard pioneered by Intel. Expansion I/O boards plug into the iSBX connector and add features such as digital I/O, counter/timers and analog output.

Expansion boards for iSBX are manufactured by ComputerBoards, Inc., Intel, General Signal, Data Translation and many others. You can be assured of the availability of a diverse range of options to customize your DAS16/330i. Call for a complete list!

SEPARATE BASE ADDRESS

Each iSBX connector has independent access to a PC base address, interrupt level and DMA channel. Entire function boards, such as a DIO-24 at base address 320H may be added simply by mounting the cSBX-DIO24 on the DAS16/330++ and setting the base address of the iSBX connector for 320H.

```
 1 1       1 1
 5 7 0 1 5 7 0 1
┌─────────┬─────────┐
│         │         │
└─────────┴─────────┘
   cSBX      cSBX
   IR 0      IR 1
```
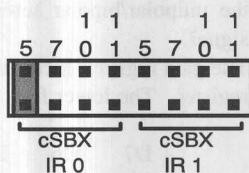
Two interrupts may be generated from each iSBX module, IR0 and IR1. These may be mapped into PC interrupts 5, 7, 10 or 11. Each iSBX module has access to DMA channels 1, 6 and 7 for high speed transfers. For even higher speeds, cSBX accessory boards, such as the cSBX-DDA04, use REP OUTSW to transfer at rates over 250KHz!

```
 1 1 6 6 7 7 0 T
┌───────────────┐
│               │
└───────────────┘
 DMA DMA DMA OPT
  1   6   7
```
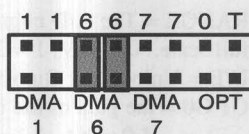
I/O & CONTROL REGISTER MAP

The CIO-DAS16/330i and MetraByte DAS-16 are 100% software compatible because the I/O registers have identical functions on each board. I/O registers are the locations to which the computer writes commands and data to, and reads status and data from. The first 16 registers of the CIO-DAS16/330i share these register functions. An additional 8 registers control advanced features

I/O ADDR.	FUNCTION R/W	I/O ADDR.	FUNCTION R-/W
BASE + 0	A/D Low Byte / Start A/D	BASE + 8	A/D Status / NA
BASE + 1	A/D High Byte / NA	BASE + 9	Control Settings / Control
BASE + 2	Mux Settings / Mux Scan Control	BASE + 10	NA / Counter Source Control
BASE + 3	Digital 4 In / Digital 4 Out	BASE + 11	Gain & Range + AT Control
BASE + 4	Not Used: These 4 registers are the	BASE + 12	Counter 0 / Counter 0 Load
BASE + 5	DAS-16 D/A control registers, and	BASE + 13	Counter 1 / Counter 1 Load
BASE + 6	are not used so that existing DAS-	BASE + 14	Counter 2 / Counter 2 Load
BASE + 7	16 software will be compatible.	BASE + 15	NA / 8254 Counter Control

I/O ADDR.	ADVANCED FEATURE REGISTERS		
BASE + 16	Counter 0 / Counter 0 Load	BASE + 21	Not Used
BASE + 17	Counter 1 / Counter 1 Load	BASE + 22	CGQ Address
BASE + 18	Counter 2 / Counter 2 Load	BASE + 23	Not Used
BASE + 19	NA / 8254 Counter Control	BASE + 24	A/D Channel/Gain Queue
BASE + 20	Not Used	BASE + 25	Not Used

COMPATIBILITY MODE

A switch on the CIO-DAS16/330i will force the board into 100% CIO-AD16 compatibility mode. In compatibility mode, the DAS16/330i has only 16 registers visible to the PC bus and those 16 are identical to a MetraByte DAS-16G. When the switch is in the ADVANCED mode, the DAS16/330i is still 100% compatible with a DAS-16G and an additional 8254 counter is present at Base + 16-19. The upper four bits of Base + 11 open up and become the high-speed A/D transfer control bits.
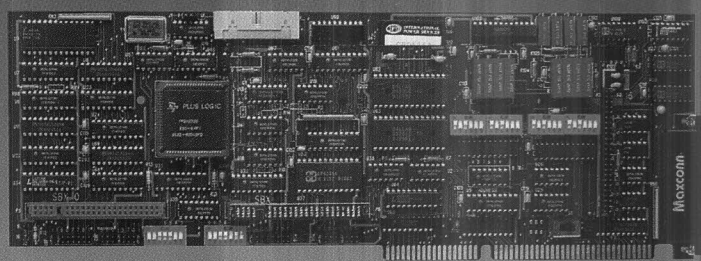
cSBX BOARDS - 100% COMPATIBLE

That's right! Just plug in a cSBX board such as the cSBX-DIO24 or cSBX-CTR05, set the base address and run all your existing software. Your investment in cables and connections is preserved as well. The cSBX boards in combination with a BP40-37 use the same 37 pin D connector as the original.

cSBX-DIO24

Digital I/O from an 82C55 in exactly the same form and function as your familiar CIO-DIO24 (PIO-12). Twenty-four TTL I/O lines in 2 eight bit and 2 four bit ports, all brought to one 37 pin D connector. See the cSBX-DIO24 and CIO-DIO24 catalog pages for more information.

cSBX-CTR05

Complex data acquisition schemes often require sophisticated counters, such as the 9513 found on the CIO-CTR05 (CTM-05). Add these counters to your DAS16/330i just by snapping on a cSBX-CTR05. See the cSBX-CTR05 and CIO-CTR-5 catalog pages for more information..

cSBX-DDA04 (Advanced D/A and Digital Output)

Want 4 independent D/A channels running at 200KHz or 14 digital outputs at 500KHz? The cSBX-DAC04 takes advantage of advanced REP OUTSW routines and FIFO buffers to move large blocks (>64K) at blazing speeds using Streaming software. Add a cSBX-DDA04 to your DAS16/330i for the fastest D/A and A/D combination available.

HIGH-SPEED CONTROL REGISTER

The DAS16/330i has a special control register. This register, located in the upper 4 bits of Base+11, controls word/byte transfers, enables the DT-Connect interface, pre/post trigger enable and FIFO status.

D7	D6	D5	D4	D3	D2	D1	D0
DTC	PTE	F/Q	B/W	Range	U/B	G1	G0

DTC = DT Connect enable. 0 = disable. 1 = enable a DT Connect "Master Out". Data is available as each A/D conversion is completed. The slave must reply before the next conversion is complete.

PTE = Post Trigger Enable. 0 = disable. 1 = Enable the post-trigger counter to demarcate the boundary between pre- and post- trigger data.

F/Q = FIFO buffer status /CGQ Active. Read: 1 = Overrun. A logical OR of the fault conditions FIFO Full, DTC overrun and DMA overrun. 0= no fault. Write: 1 = use CGQ. 0 = Use MUX addr + GAIN @ Base + 11.

B/W = Byte or Word transfers. 0 = byte, 1 = word.

Highest speed (330KHz) A/D samples are transferred using a 286/386/486 command, REP INSW, *not D.M.A!* Read more about REP INSW elsewhere in this data sheet.

SIMULTANEOUS SAMPLE & HOLD

Capture 16 channels simultaneously with less than 50 nSec of aperture uncertainty at 130KHz. The CIO-SSH16 simultaneous sample & hold accessory expands the CIO-DAS16/330i's 16 single ended, multiplexed inputs into 16 fully differential inputs with individual, switch selectable gains of up to 800 on every channel. The 16 sample & holds are triggered by the CIO-DAS16/330i once per scan as fast as the CIO-DAS16/330i will go.

The CIO-SSH16 is triggered by a CIO-DAS16/330i track & hold pulse which is generated by the CIO-DAS16/330i. on every scan. No software modifications are required to realize the benefits of simultaneous sample & hold. Just drop a CIO-DAS16/330i and CIO-SSH16 into your existing
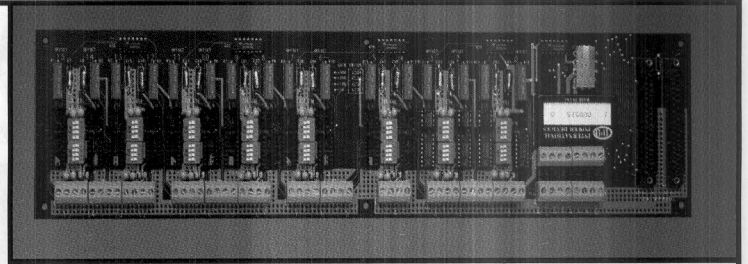
DAS-16 application. Fire up the software you've been using all along and start collecting data from simultaneous samples.
An excellent addition to audio, vibration or other multi-channel spectrum analysis applications. The cost per channel is the lowest in the industry and the performance is guaranteed.

DT CONNECT™ High Speed Direct Board-to-Board Interface

High speed transfers of data from the data acquisition board to special function boards, such as array processors or large sample buffers are best handled by dedicated interboard interfaces. Several such interfaces have been proposed by data acquisition vendors and one, DT-CONNECT has emerged as a standard.

Shown here is a high speed array processor connected to the CIO-DAS16/330. A number of vendors subscribe to the DT-CONNECT standard for interboard communication because large blocks of data may be transferred at rates up to 10,000,000 Bytes/Sec independent of the PC bus.
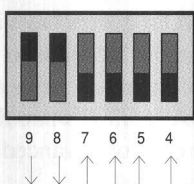
New products from ComputerBoards, Inc. will employ the DT-CONNECT interface to achieve performance and provide features otherwise unattainable in a personal computer.
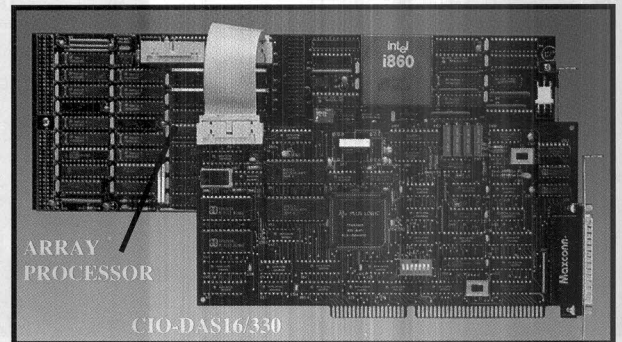
BASE ADDRESS

The base address switch controls the block of I/O addresses occupied by the CIO-DAS16/330i and iSBX expansion connectors. Each of the three base address switches may be independently set, allowing you to duplicate any address scheme presently in use! The CIO-DAS16/330i occupies 32 addresses, each CSBX connector occupies an additional 16 I/O addresses when a function board is installed.

Address 300H shown

SW	HEX
A9	200
A8	100
A7	80
A6	40
A5	20
A4	10

9 8 7 6 5 4
↓ ↓ ↑ ↑ ↑ ↑

ACCESSORIES, CABLES & CONNECTORS

BP-37 BRACKET

C37FFS-5 CABLE

CIO-TERMINAL
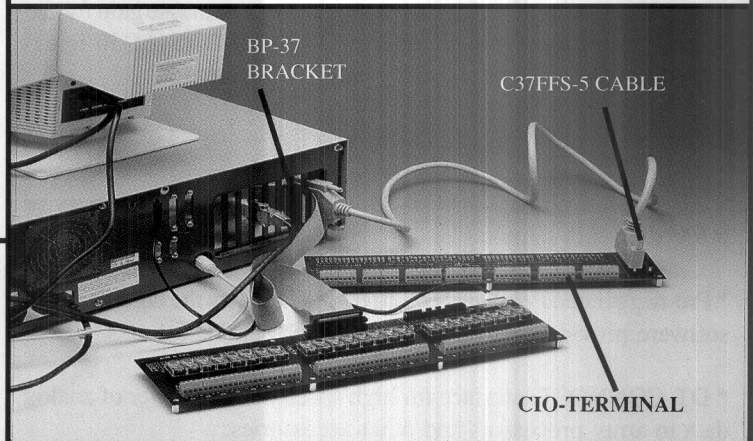
STANDARD CONNECTOR, IDENTICAL SIGNALS

The 37 pin D connector on the CIO-DAS16/330i is identical to that of the CIO-AD16 and MetraByte DAS-16.

Of course, the pins which carry analog output signals on the CIO-AD16 are no-connect (NC) on the DAS16/330i board. These pins are left floating rather than tied to ground or some other signal. That way your existing cables and connections will be compatible.

Because of Computer Boards' strict adherence to standards, accessory boards, cables and all of your existing hook-ups are 100% compatible with the DAS16/330i connector.

LLGND	19		
CH0 LOW/CH8 HIGH	18	37	CH0 HIGH
CH1 LOW /CH9 HIGH	17	36	CH1 HIGH
CH2 LOW /CH10 HIGH	16	35	CH2 HIGH
CH3 LOW /CH11 HIGH	15	34	CH3 HIGH
CH4 LOW /CH12 HIGH	14	33	CH4 HIGH
CH5 LOW /CH13 HIGH	13	32	CH5 HIGH
CH6 LOW /CH14 HIGH	12	31	CH6 HIGH
CH7 LOW /CH15 HIGH	11	30	CH7 HIGH
NC	10	29	LLGND
NC	9	28	LLGND
NC	8	27	NC
GND	7	26	SS&H OUT
DGI. IN 1	6	25	DIG. IN 0 /TRIGGER
DIG. IN 3	5	24	DIG. IN 2
DIG. OUT 1	4	23	DIG. OUT 0
DIG. 3 OUT	3	22	DIG. OUT 2
CTR 0 OUT	2	21	CTR 0 CLOCK IN
+5V PC BUS	1	20	CTR 2 OUT

VIEW FROM REAR OF PC

ORDERING GUIDE

330 KHz Max Analog Input for AT/386 bus with 2 iSBX expansion connectors.	CIO-DAS16/330i
Sample & Hold Accessory 16 Ch. S&H Diff. Amp accessory board, 4 Ch. installed.	CIO-SSH16
Additional S&H + Amps installed. Up to 12 additional.	CIO-SSH-AMP
Screw Terminal Boards	
16" X 4" all signals from one 37 D plus proto area.	CIO-TERMINAL
4" X 4" all signals from one 37 D connector.	CIO-MINI37
16" X 4" all signals from one 37D, Spade Lug Terminals.	CIO-SPADE50
Cables	
2 foot ribbon cable, 37 conductor, female connectors.	C37FF-2
'N' foot ribbon cable, 37 conductor, female connectors.	C37FF-N
5 foot shielded cable, molded female connectors, 37 cond.	C37FFS-5
10 foot shielded cable, molded female connectors, 37 cond.	C37FFS-10

CIO-DAS16/330

VERY HIGH SPEED - 330KHz 16 Channel 12 Bit Analog Input

DT CONNECT BOARD-TO-BOARD HIGH SPEED DATA TRANSFER

DC/DC +/-15V ALL ANALOG POWER

330KHz, 3uS A/D

PROGRAMMABLE GAINS
+/-10V, +/-5V, +/-2.5V, +/-1.25V, +/-0.625V
0-10V, 0-5V, 0-2.5V, 0-1.25V

16 SINGLE ENDED 8 DIFFERENTIAL

1024 SAMPLE FIFO BUFFER

37 PIN CONNECTOR DAS-16 COMPAT-IBLE

100% DAS-16 REGISTER COMPATIBLE WORKS WITH OLD OR NEW SOFTWARE

AT BUS REP INSW HIGH SPEED BLOCK TRANSFER

BASE ADDRESS SWITCH

DMA 1 OR 3 SELECT

LITTLE BROTHER TO THE DAS16/330i

The CIO-DAS16/330 is a subset of the CIO-DAS16/330i. There are two features of the 330i that the 330 does NOT share. 1) There are no iSBX connectors. 2) There is a single programmable gain for the board, not a programmable queue. The CIO-DAS16/330 is designed for applications requiring only analog input.

Enhanced features include:

* Blazing fast analog input of 330KHz continuous to memory or RAM disk with sample size limited only by the size of RAM disk.

* Pre-trigger and Post-trigger buffers managed by the hardware and software provide a seamless event driven sample set.

* DT-CONNECT interface for high speed direct transfer of analog data to array processors and other accessories.

BEYOND THE 64K BARRIER

The CIO-DAS16/330 acquires sample sets of greater than 32K samples (64KB of memory) by employing advanced instructions; just as do LAN and hard disk controllers.

160KHz FROM OLD SOFTWARE

Even old software runs better with the CIO-DAS16/330. Replace the DAS-16 you currently use and suddenly the max acquisition rate jumps to 160KHz. Labtech Notebook, Snap-Shot, ASYST, CTOOLS; all of these software packages are improved to 160KHz by the addition of a CIO-DAS16/330!

PLEASE See TheCIO-DAS16/330i Data Sheet
For More Details on DAS16/330 Features!

I/O & CONTROL REGISTER MAP

The CIO-DAS16/330 and DAS-16 are software compatible because the I/O registers have identical functions on each board. I/O registers are the locations to which the computer writes commands and data to, and reads status and data from. The first 16 registers of the CIO-DAS16/330 share these register functions. An additional 4 registers control advanced features

I/O ADDR.	FUNCTION R/W	I/O ADDR.	FUNCTION R -/W
BASE + 0	A/D Low Byte / Start A/D	BASE + 8	A/D Status / NA
BASE + 1	A/D High Byte / NA	BASE + 9	Control Settings / Control
BASE + 2	Mux Settings / Mux Scan Control	BASE + 10	NA / Counter Source Control
BASE + 3	Digital 4 In / Digital 4 Out	BASE + 11	Gain & Range + AT Control
BASE + 4	Not Used: These 4 registers are the	BASE + 12	Counter 0 / Counter 0 Load
BASE + 5	DAS-16 D/A control registers, and	BASE + 13	Counter 1 / Counter 1 Load
BASE + 6	are not used so that existing DAS-	BASE + 14	Counter 2 / Counter 2 Load
BASE + 7	16 software will be compatible.	BASE + 15	NA / 8254 Counter Control

I/O ADDR.	ADVANCED FEATURE REGISTERS		
BASE + 16	Counter 0 / Counter 0 Load	BASE + 18	Counter 2 / Counter 2 Load
BASE + 17	Counter 1 / Counter 1 Load	BASE + 19	NA / 8254 Counter Control

COMPATIBILITY MODE

A switch on the CIO-DAS16/330 will force the board into 100% CIO-AD16 compatibility mode. In compatibility mode, the DAS16/330 has only 16 registers visible to the PC bus and those 16 are identical to a DAS-16. When the switch is in the ADVANCED mode, the DAS16/330 is still 100% compatible with a DAS-16 and an additional 8254 counter is present at Base + 16-19. The upper four bits of Base + 11 open up and become the high-speed A/D transfer control bits.

PROGRAMMING LANGUAGE SUPPORT

The CIO-DAS16/330 is supported by Universal Driver language support for Basic, C and PASCAL. Please see the data sheet and order Universal Driver if you wish to write programs for the CIO-DAS16/330.

Call for Friendly Technical Assistance - (508) 261-1123

ANALOG INPUTS

The analog input section of the CIO-DAS16/330 has been designed for high speed, flexibility and accuracy in a number of configurations and ranges. The analog signals are brought on board by a standard 37 pin D connector directly to two multiplexors. The two multiplexors may be configured as 16 channels of single ended input or 8 channels of differential input. Differential inputs can reject noise and ground loops (common mode voltages) but require a 3 wire hookup as opposed to 2.

Signals are amplified by a programmable gain amplifier prior to conversion by the A/D converter. The possible gains and ranges and associated codes are shown in the table to the right.

An integral sample & hold captures the signal which is then converted by the A/D converter. The 12 bit A/D converter provides a resolution of 1/4095 parts of full scale.

The speed of data gathering may vary from less than 1Hz to 330KHz. Acquisition speed is dependent on the method of triggering and data transfer.

METHOD	MAX A/D Speed
Polled by software	4KHz-20KHz
Interrupt Service Routine (no REP INSW)	4KHz - 20KHz
DMA	160KHz
REP INSW	330KHz

DMA IS DEAD! The REP INSW story.

REP INSW (Repeat Input String) is a 286/386/486 class CPU instruction which allows the PC to transfer large amounts of data using one instruction. The data is transferred at the maximum rate allowed by the bus. On a typical 286 AT, this rate is 2Mbyte/sec or 1 sample every microsecond.

In order to employ REP INSW the A/D board must have a FIFO buffer to accumulate sample data. The CIO-DAS16/330 has a 1024 sample buffer. When it is half full (512 samples), an interrupt generated by the DAS16/330 starts an interrupt service routine which executes the instruction REP INSW, transfers the data to PC memory and empties the FIFO buffer.

The data is transferred completely in the background and no unreasonable demands are placed on the PC's resources. For example, screen updates need not be suspended! REP INSW is the same method LAN and disk controllers employ.

A/D SPECIFICATIONS   12 BIT

Channels	16 SE or 8 Differential
A/D Type	Successive Approx. ADS 7800
Conversion Time	3 uS
A/D Convert & Transfer Speed	330KHz
Accuracy	0.01% +/- 1 LSB
Integral Linearity	+/- 1 LSB
No missing codes guaranteed over temp. range.	
Maximum Overvoltage	+/- 35V Continuous
Input Leakage Current	250 nA Max @ 25°C
Gain Drift	+/- 25 ppm/Deg C Max
Zero Drift	+/- 10 ppm/Deg C Max

GAIN & RANGE PROGRAMMING

No need to set switches to select an analog input range. The analog input range is fully programmable. A single write to Base + 11 controls both the unipolar/bipolar setting and the amplification of the analog input signal.

The gain register, located at the board's Base + 11 address, is an eight bit register. The lower four bits control the gain and range.

D7	D6	D5	D4	D3	D2	D1	D0
X	X	X	X	Range	U/B	G1	G0

RANGE = The A/D chip input range, either 10V full scale or 20V full scale. 0 = 10V, 1 = 20V.

U/B = Unipolar or Bipolar ranges. 0 = Bipolar, 1 = Unipolar.

G1 G0 = the gain of the input amplifier. 0,0 = X1. 0,1 = X2. 1,0 = X4. 1,1 = X8.

This is a chart of all four bits assembled into a control nibble.

Range	U/B	G1	G0	Input Range
1	0	0	0	+/- 10V
0	0	0	0	+/- 5V
0	0	0	1	+/- 2.5V
0	0	1	0	+/- 1.25V
0	0	1	1	+/- 0.625V
0	1	0	0	0 to 10V
0	1	0	1	0 to 5 V
0	1	1	0	0 to 2.5V
0	1	1	1	0 to 1.25V

HIGH-SPEED CONTROL REGISTER

The DAS16/330 has a special control register. This register, located in the upper 4 bits of Base+11, controls word/byte transfers, enables the DT-Connect interface, pre/post trigger enable and FIFO status.

D7	D6	D5	D4	D3	D2	D1	D0
DTC	**PTE**	**FIFO**	**B/W**	Range	U/B	G1	G0

ORDERING GUIDE

330 KHz Max Analog Input for AT/386 bus	CIO-DAS16/330

Sample & Hold Accessory

16 Ch. S&H Diff. Amp accessory board, 4 Ch. installed.	CIO-SSH16
Additional S&H + Amps installed. Up to 12 additional.	CIO-SSH-AMP

Screw Terminal Boards

16" X 4" all signals from one 37 D plus proto area & circuitry.	CIO-TERMINAL
4" X 4" all signals from one 37 D connector.	CIO-MINI37
16" X 4" all signals from one 37D, Spade Lug Terminals.	CIO-SPADE50

Cables

2 foot ribbon cable, 37 conductor, female connectors.	C37FF-2
'N' foot ribbon cable, 37 conductor, female connectors.	C37FF-N
5 foot shielded cable, molded female connectors, 37 cond.	C37FFS-5
10 foot shielded cable, molded female connectors, 37 cond.	C37FFS-10

CIO-DAS16 & CIO-DAS16/F

High Speed 16 Channel 12 Bit Analog Input, 2 Channel 12 Bit Analog Output with 32 Digital I/O & 3, 16 Bit Counters

37 PIN D CONNECTOR PIO-12 COMPATIBLE

8254 16 BIT (3) COUNTER/TIMER

TWO 12 BIT D/A CONVERTERS

JUMPER BLOCK FOR SIMULTANEOUS S&H AND D/A REFERENCE

A/D CONVERTER 12 BIT (1/4095) 674 = 50KHz 774 = 100KHz

16 SINGLE ENDED OR 8 DIFFERENTIAL A/D INPUT SWITCH

8255 DIGITAL I/O 24 TTL I/O LINES

GAIN & RANGE SELECT SWITCH ACCESSIBLE FROM OUTSIDE PC

37 PIN D CONNECTOR

8255 BASE ADDRESS = BOARD BASE + 16 32 DIGITAL I/O LINES BOARD TOTAL

BASE ADDRESS SWITCH

PC/XT/AT/386/PS30 CONNECTOR

DMA LEVEL SELECT 1 OR 3

DESCRIPTION

The CIO-DAS16 multifunction analog and digital I/O board is designed to be run the same software and use the same connector as MetraByte's popular DAS-16 and provide additional features, all at a lower cost.

Installed in any IBM PC/XT/AT/PS30 or compatible computer the CIO-DAS16 turns your personal computer into a high speed data acquisition and control station suitable for laboratory data collection, instrumentation, production test, or industrial monitoring.

The CIO-DAS16 is supported by a broad range of software to allow programmed control in BASIC, C and PASCAL. Many menu controlled data logging, analysis and control programs are available from a number of third party developers. In fact, any software designed for MetraByte's popular DAS-16 will work with the CIO-DAS16; we guarantee it!

In addition, the CIO-DAS16 comes with a complete CIO-DIO24 compatible 8255 and 37 pin connector!

BLOCK DIAGRAM

Call for Friendly Technical Assistance - (508) 261-1123
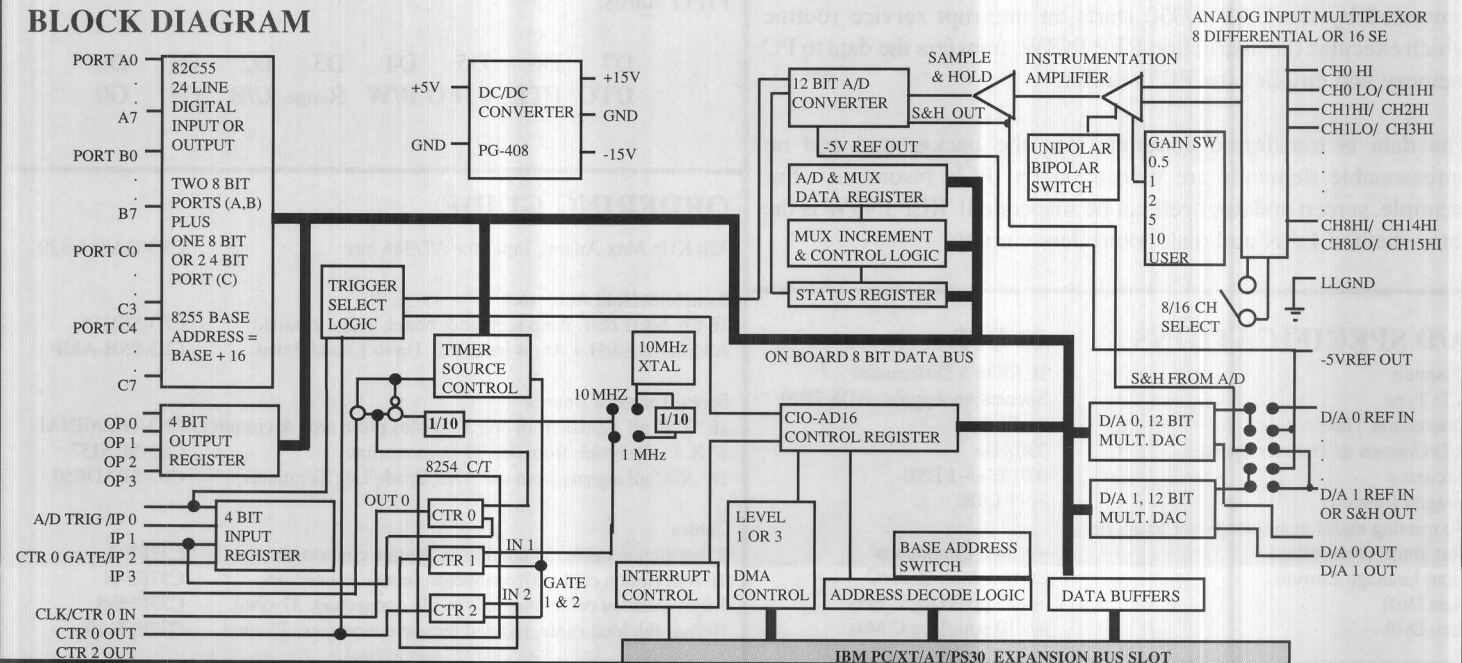
FUNCTIONAL DESCRIPTION

ANALOG INPUTS

The analog input section of the CIO-DAS16 has been designed for flexibility and accuracy in a number of configurations and ranges. The analog signals are brought on board by a standard 37 pin D connector directly to two multiplexors. The two multiplexors may be configured as 16 channels of single ended input or 8 channels of differential input. Differential inputs can reject noise and ground loops (common mode voltages) but require a 3 wire hookup as opposed to 2. Please see the diagram on the opposite page.

A 2 uSec sample & hold captures the signal which is amplified by 0.5, 1, 2, 5 or 10 times before conversion by a 674 (50KHz) or 774 (100KHz) A/D converter. The 12 bit A/D converter provides a resolution of 1/4095 parts of full scale. Please see the gain and range switch configuration diagram on the opposite page.

The speed of data gathering is dependent on the method of triggering and data transfer, as the table below illustrates.

A/D CONVERSION SPEED

TRIGGER/TRANSFER	PC 4.77 MHz	386/20MHz
Polled/ Transfer to variable	320	2,200
Interrupt/ Variable or array	4,000	20,000
DMA/ CIO-DAS16	50,000	50,000
DMA/ CIO-DAS16/F	100,000	100,000

SIMULTANEOUS SAMPLE & HOLD

Simultaneous Sample & Hold is an option which allows 16 analog input channels to be triggered simultaneously. This option is important to applications where channel to channel skew is not acceptable, such as audio digitization.

The CIO-DAS16 can trigger an external CIO-SSH16 via the unused D/A REF1 input (pin 26, see block diagram). The CIO-SSH16 reduces channel to channel skew from a minimum of 10 uS (CIO-DAS16/F) to zero with less than 50 nS aperture uncertainty.
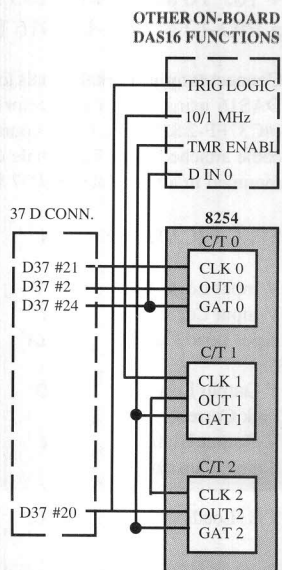
COUNTER TIMER

The 8254 counter/timer chip has 3 counters of 16 bits each. Much of the 8254 is used by the CIO-DAS16 as a pacer clock to synchronize A/D conversions.

One full counter, counter 0, is available for counting, pulse generation or frequency measurement.

The output of counter 2 is available to provide external synchronization to the A/D converter or as a programmable rate source.

If you desire additional counters, a 10 counter CIO-CTR10 is available.

CLK Input Freq. . . . . . 10 MHz Max
TTL Loads . . . . Source 1, Sink 4

OTHER ON-BOARD DAS16 FUNCTIONS

TRIG LOGIC
10/1 MHz
TMR ENABL
D IN 0

37 D CONN.

8254

C/T 0
CLK 0
OUT 0
GAT 0

D37 #21
D37 #2
D37 #24

C/T 1
CLK 1
OUT 1
GAT 1

C/T 2
CLK 2
OUT 2
GAT 2

D37 #20

ANALOG OUTPUT

Analog voltage output is provided by two 12 bit multiplying D/A converters. This type of converter accepts a reference voltage and provides an output proportional to that. A precision -5V reference from the A/D converter provides an on-board D/A range of 0-5V. Other ranges between +/-10V are possible if you supply a +10V or -10V external reference at pin #10 or #26 of the 37 pin D connector.

The D/A converters do have program and interrupt transfer capability. Interrupts may be initiated by the on-board pacer clock or by external trigger. The D/A converters do not have DMA transfer capability.

TRIGGERING

A Trigger is the event that begins an acquisition/transfer cycle. There are three ways to trigger a CIO-DAS16; software, internal or external. There are also three ways to transfer data from the CIO-DAS16; program, interrupt service routine or DMA.

An internal trigger is useful for synchronizing samples to a known time base; the on board XTAL and 8254 programmable divider. Using an external trigger allows you to synchronize samples to an external event.

I/O & CONTROL REGISTER MAP

The CIO-DAS16 and MetraByte DAS-16 are 100% software compatible because the I/O registers have identical functions on each board. I/O registers are the locations to which the computer writes and reads commands, status and data.

I/O ADDR.	CIO-DAS16 FUNCTION R-W	I/O ADDR.	CIO-DAS16 FUNCTION R-W
BASE + 0	A/D Low Byte - Start A/D	BASE + 8	A/D Status - NA
BASE + 1	A/D High Byte - NA	BASE + 9	Control Settings - Control
BASE + 2	Mux Settings - Mux Scan Control	BASE + 10	NA - Counter Source Control
BASE + 3	Digital 4 In - Digital 4 Out	BASE + 11	Not Used
BASE + 4	NA - D/A0 Low Byte Out	BASE + 12	Counter 0 - Counter 0 Load
BASE + 5	NA - D/A0 High Byte Out	BASE + 13	Counter 1 - Counter 1 Load
BASE + 6	NA - D/A1 Low Byte Out	BASE + 14	Counter 2 - Counter 2 Load
BASE + 7	NA - D/A1 High Byte Out	BASE + 15	NA - 8254 Counter Control
	8255 FUNCTION R - W		**8255 FUNCTION R-W**
BASE + 16	Port A In - Port A Out	BASE + 18	Port C In - Port C Out
BASE + 17	Port B In - Port B Out	BASE + 19	NA - 8255 Control

A/D SPECIFICATIONS   12 BIT

Channels	16 SE or 8 Differential
A/D Type	Successive Approx. AD74 Series
Conversion Time	8.5 uS 774, 15 uS 674
A/D Convert & Transfer Speed (DMA)	100KHz AD16/F, 50KHz DAS16
Accuracy	0.01% +/- 1 LSB
Integral Linearity	+/- 1 LSB
No missing codes guaranteed over temp. range.	
Maximum Overvoltage	+/- 35V Continuous
Input Leakage Current	250 nA Max @ 25°C
Gain Drift	+/- 25 ppm/Deg C Max
Zero Drift	+/- 10 ppm/Deg C Max

D/A SPECIFICATIONS   12 BIT

Channels	2
D/A Type	Multiplying 4 Quadrant
Conversion Time	30nS to 0.01%
Integral Linearity	+/- 1/2 LSB
Differential Linearity	+/- 1/2 LSB
Reference Range	+/- 10V
Output Range	+/- 10V, Reference dependent
R Out	0.1 Ohm Max
I Out	+/- 5mA Min

CIO-DAS16 CONNECTOR
(METRABYTE DAS-16 COMPATIBLE)

ACCESSIBLE FROM REAR OF PC

```
LEFT = UNIPOLAR       S5 L        RIGHT = BIPOLAR    S5 R
+/- 5V                S4 L                           S4 R
SHOWN HERE            S3 L                            S3 R
                      S2 L                            S2 R
LEFT = USER GAIN OUT              RIGHT = USER GAIN IN
```

LOW LEVEL GROUND	19	37	CH0 HIGH IN
CH 0 LOW IN / CH 8 HIGH IN	18	36	CH 1 HIGH IN
CH 1 LOW IN / CH 9 HIGH IN	17	35	CH 2 HIGH IN
CH 2 LOW IN / CH 10 HIGH IN	16	34	CH 3 HIGH IN
CH 3 LOW IN / CH 11 HIGH IN	15	33	CH 4 HIGH IN
CH 4 LOW IN / CH 12 HIGH IN	14	32	CH 5 HIGH IN
CH 5 LOW IN / CH 13 HIGH IN	13	31	CH 6 HIGH IN
CH 6 LOW IN / CH 14 HIGH IN	12	30	CH 7 HIGH IN
CH 7 LOW IN / CH 15 HIGH IN	11	29	LOW LEVEL GND
D/A 0 REF IN	10	28	LOW LEVEL GND
D/A 0 OUT	9	27	D/A 1 OUT
-5 REF. VOLTAGE	8	26	D/A 1 REF IN / SIMUL. S&H OUT
POWER GROUND	7	25	DIGITAL INPUT 0 / TRIGGER 0
DIGITAL INPUT 1	6	24	DIGITAL INPUT 2 / CTR 0 GATE
DIGITAL INPUT 3	5	23	DIGITAL OUTPUT 0
DIGITAL OUTPUT 1	4	22	DIGITAL OUTPUT 2
DIGITAL OUTPUT 3	3	21	COUNTER 0 CLOCK INPUT
COUNTER 0 OUT	2	20	COUNTER 2 OUTPUT
+5 VOLTS PC BUS POWER	1		
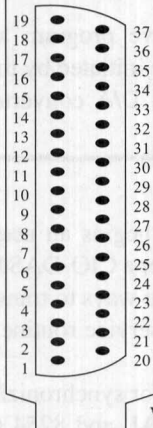
VIEW FROM REAR OF PERSONAL COMPUTER

16/8 CHANNEL SWITCH

A switch on the CIO-DAS16 configures the analog inputs as either 8 channels of differential input or 16 channels of single ended input.

16 [ ] 8

```
CH0 HI ——————— SIG HI
CH0 LO ——————— SIG LO
GND ———(V)——— SIG GND
```

DIFFERENTIAL INPUT IS A 3 WIRE ANALOG CONNECTION WHICH IS LESS SUSCEPTIBLE TO NOISE AND GROUND LOOPS.

```
CH0 HI ——————— SIG HI
GND ——————— GND
```
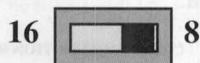
SINGLE ENDED INPUT IS A 2 WIRE ANALOG CONNECTION WHICH IS FINE FOR MOST APPLICATIONS.

DMA LEVEL SELECT

The CIO-DAS16 can use DMA levels 1 or 3, providing full compatibility with PC/XT/AT/PS30.

1 [ ] 3
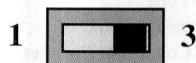
BASE ADDRESS SELECTION

The CIO-DAS16 is addressed through software at an I/O address set by the switch shown here. The switch selects the first or BASE address. Switches have values in the down position. Values are added.

SW No.	HEX VALUE	DECIMAL VALUE	Example
A9	200	512	**512**
A8	100	256	**+ 256**
A7	80	128	**+ 0**
A6	40	64	**+ 0**
A5	20	32	**+ 0**
A4	10	16	**+ 0**
			= 768

BASE ADDRESS IS SET FOR 300 HEX, 768 DEC.

```
UP
DN
   9 8 7 6 5 4
```
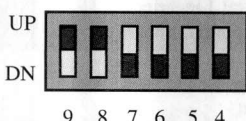
GAIN & RANGE SELECTION

Six range & gain combinations including one user selectable gain are provided by selecting options from the gain & range switches, as seen in the diagram to the left.

The gain & range switches are all accessible from the outside of the computer through a cut-out in the mounting bracket.

SWITCH POSITION

S1	S2	S3	S4	S5	GAIN	BIPOLAR S6=RIGHT	UNIPOLAR S6=LEFT	RESOLUTION
L	L	L	L	L	0.5	+/- 10V	N/A	4.88 mV / BIT
L	L	L	L	R	1	+/- 5V	0 - 10 V	2.44 mV / BIT
L	L	L	R	R	2	+/- 2.5V	0 - 5 V	1.22 mV / BIT
L	L	R	L	R	5	+/- 1V	0 - 2 V	0.488 mV / BIT
L	R	L	L	R	10	+/- 0.5V	0 - 1 V	0.244 mV / BIT
R	L	L	L	R	0.5<U<20	USER	USER	SEE EQUATION

USER SUPPLIED GAIN: You may install a resistor on the CIO-DAS16 and provide a custom gain that exactly matches your application. There are limits to the achievable gain. The limits, and the formula for selecting a resistor are supplied here.

USER GAIN EQUATION:

$$R_{USER} = \frac{20,000 * V_{FS}}{(10 - V_{FS})} \qquad V_{FS} = \frac{10 * R_{USER}}{R_{USER} + 20,000}$$

USE THIS EQUATION TO SELECT THE CORRECT RESISTOR FOR A SPECIFIC FULL SCALE RANGE.

USE THIS EQUATION TO DETERMINE THE RANGE FOR THE RESISTOR YOU HAVE.

EXAMPLE: FOR A RANGE OF 0 TO $0.5V_{FS}$ (+/-0.25V BIPOLAR) THE CALCULATED RESISTOR IS 1053 OHMS.

V_{FS} = THE FULL SCALE UNIPOLAR VOLTAGE RANGE. FOR BIPOLAR DIVIDE V_{FS} BY 2 AND ADD +/-.

MAX RANGE = 0 TO 10V UNI, +/- 10V BIP :: **MIN RANGE** = 0 TO 0.5V UNI, +/- 0.25V BIP

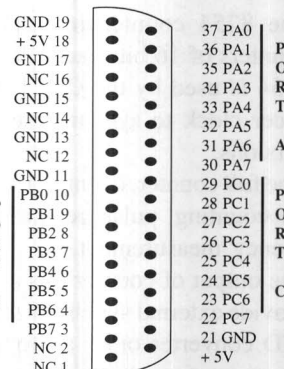## 24 BIT DIGITAL I/O CONNECTOR
(METRABYTE PIO-12 COMPATIBLE)

A 37 Pin D type connector, mounted on the CIO-DAS16 board is the connector for a PIO-12 compatible 24 line bi-directional digital I/O port. The 8255 on board raises the digital I/O count to 32 lines. The 8255 BASE address is located at CIO-DAS16 BASE address + 16. To access the 8255 from a menu driven program just install a PIO-12 at CIO-DAS16 BASE + 16!

Connect external digital signals to the CIO-DAS16 using a 37 pin connector and cable (#C37FF-2 $25) or a 37 pin connector and cable attached to a 37 pin male connector mounted in a backplate (#BP37 $25).

SPECIFICATIONS	MIN	MAX
V Input Logic Low	-0.5V	0.8V
V Input Logic High	2.0V	5.0V
Input Load Current	-10uA	10uA
V Output Low	GND	0.45V
Sink Current		2.5mA
V Output High	2.4V	
Source Current		2.5mA
TTL Loads	1 SRC	4 SNK

GND	19	37	PA0
+ 5V	18	36	PA1
GND	17	35	PA2
NC	16	34	PA3
GND	15	33	PA4
NC	14	32	PA5
GND	13	31	PA6
NC	12	30	PA7
GND	11	29	PC0
PB0	10	28	PC1
PB1	9	27	PC2
PB2	8	26	PC3
PB3	7	25	PC4
PB4	6	24	PC5
PB5	5	23	PC6
PB6	4	22	PC7
PB7	3	21	GND
NC	2		+ 5V
NC	1		

PORT A, PORT C, PORT B

VIEW FROM COMPONENT SIDE OF CIO-DAS16

Call for Friendly Technical Assistance - (508) 261-1123
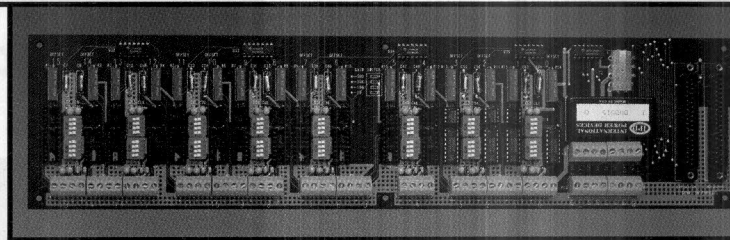
SIMULTANEOUS SAMPLE & HOLD

Capture 16 channels simultaneously with less than 50 nSec of aperture uncertainty at 100KHz. The CIO-SSH16 simultaneous sample & hold accessory expands the CIO-DAS16's 16 single ended, multiplexed inputs into 16 fully differential inputs with individual, switch selectable gains of up to 800 on every channel. The 16 sample & holds are triggered by the CIO-DAS16 once per scan as fast as the CIO-DAS16 will go.

The CIO-SSH16 is triggered by a CIO-DAS16 track & hold pulse which is generated by the CIO-DAS16 on every scan. No software modifications are required to realize the benefits of simultaneous sample & hold. J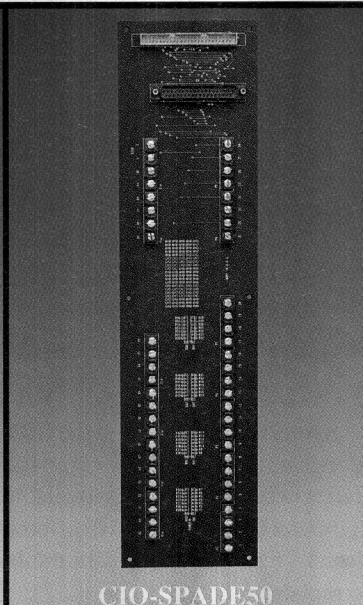ust drop a CIO-DAS16 and CIO-SSH16 into your existing DAS-16 application. Fire up the software you've been using all along and start collecting data from simultaneous samples.

An excellent addition to audio, vibration or other multi-channel spectrum analysis applications. The cost per channel is the lowest in the industry and the performance is guaranteed.
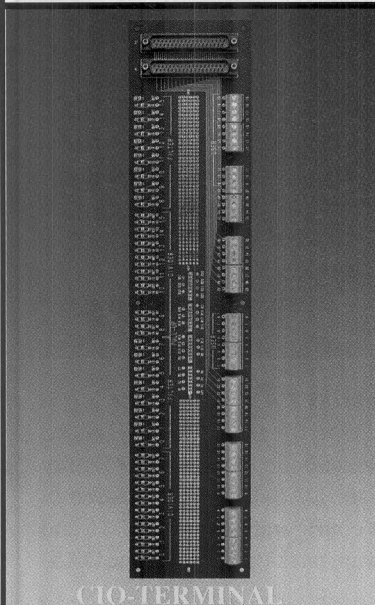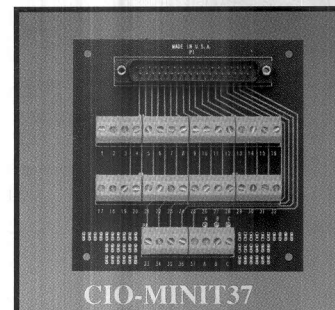
SCREW TERMINAL ACCESSORIES

Screw terminal boards accept 12-22 AWG wire or spade lugs. The CIO-TERMINAL provides prototype area, pull up resistor, filter and divider circuitry you can populate.

The CIO-SPADE50 has tough spade lugs in a 16" X 4" form factor for easy NEMA cabinet or rack mounting. A good termination panel for industrial applications.

The CIO-MINITERM is the most compact and economical terminal board available. Forty screw terminals provide access to all 37 CIO-DAS16 signals plus 4 spares. Two small proto areas are just enough for an op-amp or a few passives.

CIO-TERMINAL   CIO-SPADE50   CIO-MINIT37

CABLES & CONNECTORS

Highest quality cables and connectors of all lengths are available from stock. The CIO-DAS16 has male 37 D connectors as do the accessory and screw terminal boards. The cables which mate A/D board to screw terminal are terminated with 37 D female connectors at each end. Shielded cables of 5 and 10 feet and ribbon cables of all lengths are available.

C37FFS-5 SHIELDED
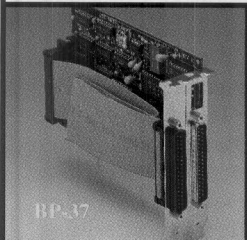
C37FF-2 RIBBON

The BP37 brings signals from internal connectors to the rear of the PC, where a standard cable joins the BP37 to accessory boards. The BP37 is shown here with a CIO-DAS08.

BP-37
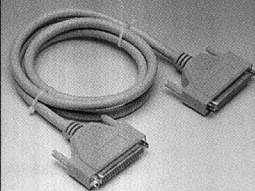
ORDERING GUIDE

CIO-DAS16 comes in two speeds.

50 KHz Max Analog Input	CIO-DAS16
100 KHz Max Analog Input	CIO-DAS16/F

Sample & Hold Accessory

16 Ch. S&H Diff. Amp accessory board, 4 Ch. installed.	CIO-SSH16
Additional S&H + Amps installed. Up to 12 additional.	CIO-SSH-AMP

Screw Terminal Boards

16" X 4" all signals from one 37 D plus proto area & circuitry.	CIO-TERMINAL
4" X 4" all signals from one 37 D connector.	CIO-MINI37
16" X 4" all signals from one 37D, Spade Lug Terminals.	CIO-SPADE50

Cables

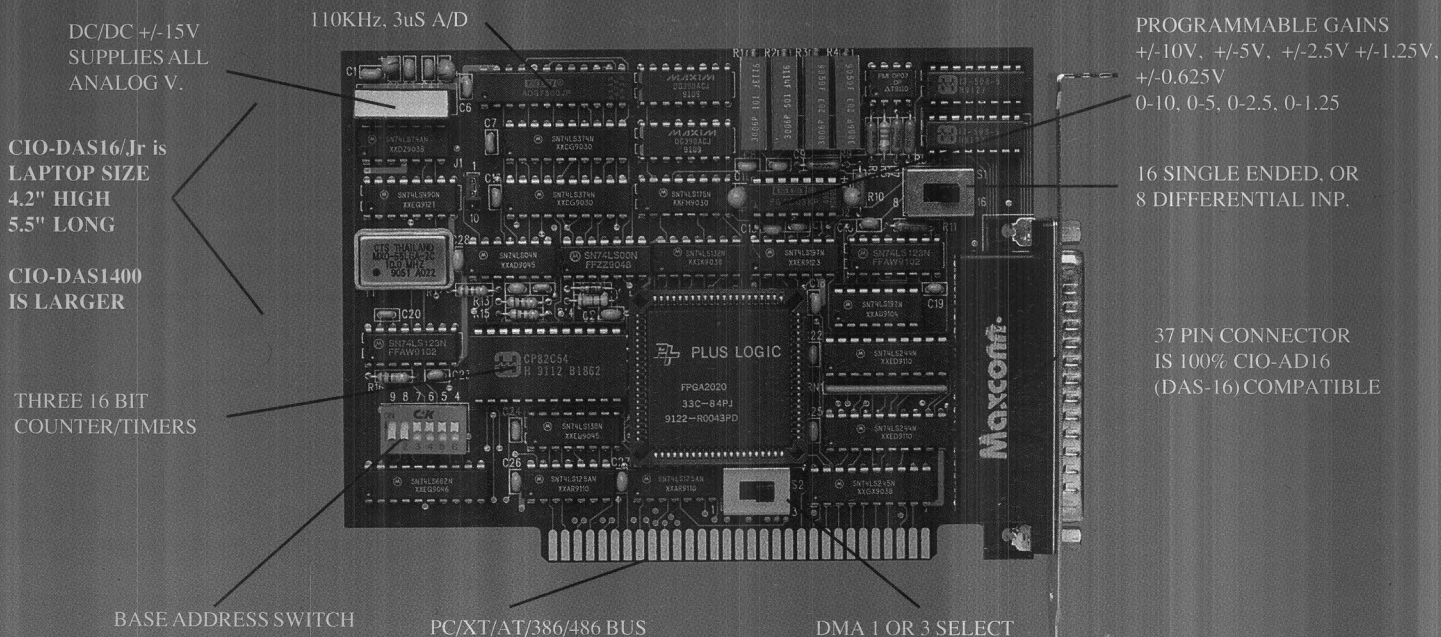|	
2 foot ribbon cable, 37 conductor, female connectors.	C37FF-2
'N' foot ribbon cable, 37 conductor, female connectors.	C37FF-N
5 foot shielded cable, molded female connectors, 37 cond.	C37FFS-5
10 foot shielded cable, molded female connectors, 37 cond.	C37FFS-10

PROGRAMMING LANGUAGE SUPPORT

To program the CIO-DAS16, or any ComputerBoards product, please see the data sheet on the Universal Driver, and order a copy with your data acquisition and control board.

CIO-DAS1400 & CIO-DAS16/Jr

VERY LOW COST - High Speed 16 Channel 12 Bit Analog Input

DC/DC +/-15V SUPPLIES ALL ANALOG V.

110KHz, 3uS A/D

PROGRAMMABLE GAINS
+/-10V, +/-5V, +/-2.5V +/-1.25V,
+/-0.625V
0-10, 0-5, 0-2.5, 0-1.25

CIO-DAS16/Jr is LAPTOP SIZE 4.2" HIGH 5.5" LONG

CIO-DAS1400 IS LARGER

16 SINGLE ENDED, OR 8 DIFFERENTIAL INP.

THREE 16 BIT COUNTER/TIMERS

37 PIN CONNECTOR IS 100% CIO-AD16 (DAS-16) COMPATIBLE

BASE ADDRESS SWITCH

PC/XT/AT/386/486 BUS

DMA 1 OR 3 SELECT

ANALOG INPUT - DAS16 STYLE

The CIO-DAS1400 and CIO-DAS16/Jr multifunction analog and digital I/O board is 100% compatible with the DAS-16 analog input. It is smaller, acquires data faster and consumes less power. Designed for applications where price is a factor and only analog input is desired, the CIO-DAS1400 and CIO-DAS16/Jr provide:

* Acquire data at 130KHz with existing DAS-16 software.
* Fully programmable gain.
* Smaller footprint, fewer components.
* Consumes only 5V from PC.
*OEM Power engine for analog data acquisition.

LAPTOP COMPUTERS can become high speed data acquisition systems. Just add the CIO-DAS16Jr! It is so small (5.5" X 4.2") it will fit in any laptop PC, and, it draws only 5V @ 300mA from the laptop's power supply.

WHY DAS1400 *AND* DAS16/Jr

ComputerBoards introduced the CIO-DAS16/Jr in 1991, introducing the concept of a small DAS-16 family board. MetraByte introduced the DAS1400 in 1992. Being a provider of clones, we had to provide a CIO-DAS1400 as well. There are three differences between the Jr and the 1400. 1) The Jr has a fully programmable gain, the 1400 has a partially programmable gain. 2) The CIO-DAS16/Jr supports the CIO-SSH16 sample & hold accessory. 3) The 1400 has an added A/D mode called 'Burst Mode', borrowed from its big brother the DAS-1600. The Jr does not have burst mode.
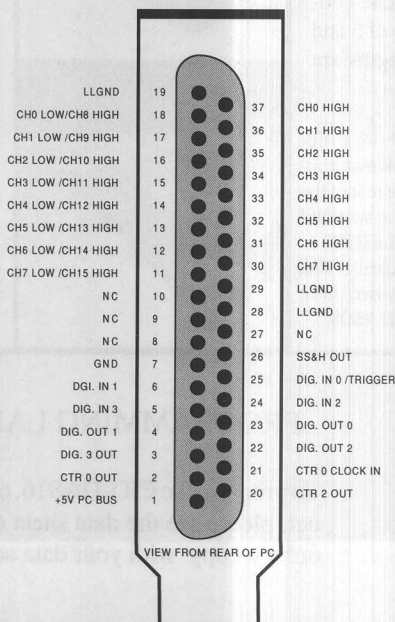
WHICH ONE IS BETTER?

The Jr has better programmability and SS&H while the 1400, in two versions, has more ranges plus burst mode. They are both the same price.

DAS16 FAMILY COMPATIBILITY

ComputerBoards designed the CIO-DAS16Jr and CIO-DAS1400 to be register and connector compatible with the most popular family of data acquisition boards available; the DAS-16 family. Currently ComputerBoards offers 10 different configurations of DAS-16 and virtually every data acquisition software package supports the DAS-16 register set.

If you have applications designed for the DAS-16 and are ready to propagate those either within your facility or as a commercial product, these smaller, less expensive DAS16s may be just what you need. As the following diagram shows, connector compatibility is assured.

LLGND	19	
CH0 LOW/CH8 HIGH	18	37 CH0 HIGH
CH1 LOW /CH9 HIGH	17	36 CH1 HIGH
CH2 LOW /CH10 HIGH	16	35 CH2 HIGH
CH3 LOW /CH11 HIGH	15	34 CH3 HIGH
CH4 LOW /CH12 HIGH	14	33 CH4 HIGH
CH5 LOW /CH13 HIGH	13	32 CH5 HIGH
CH6 LOW /CH14 HIGH	12	31 CH6 HIGH
CH7 LOW /CH15 HIGH	11	30 CH7 HIGH
NC	10	29 LLGND
NC	9	28 LLGND
NC	8	27 NC
GND	7	26 SS&H OUT
DGI. IN 1	6	25 DIG. IN 0 /TRIGGER
DIG. IN 3	5	24 DIG. IN 2
DIG. OUT 1	4	23 DIG. OUT 0
DIG. 3 OUT	3	22 DIG. OUT 2
CTR 0 OUT	2	21 CTR 0 CLOCK IN
+5V PC BUS	1	20 CTR 2 OUT

VIEW FROM REAR OF PC

The 37 pin D connector on the CIO-DAS16Jr and CIO-DAS1400 is identical to that of the CIO-DAS16 and MetraByte DAS-16.

Of course, the pins which carry analog output signals on the CIO-DAS16 are no-connect (NC) on the Jr. boards. These pins are left floating rather than tied to ground or some other signal. That way an existing cable with a signal on it is not a problem.

Because of Computer Boards' strict adherence to standards, accessory boards, cables and all of your existing hook-ups are 100% compatible with the CIO-DAS16Jr connector

Call for Friendly Technical Assistance - (508) 261-1123

ANALOG INPUTS

The analog input section of the CIO-DAS1400 and CIO-DAS16Jr. has been designed for flexibility and accuracy in a number of configurations and ranges. The analog signals are brought on board by a standard 37 pin D connector directly to two multiplexors. The two multiplexors may be configured as 16 channels of single ended input or 8 channels of differential input. Differential inputs can reject noise and ground loops (common mode voltages) but require a 3 wire hookup as opposed to 2.

Signals are amplified by a programmable gain amplifier prior to conversion by the A/D converter.

An integral sample & hold captures the signal which is then converted by the A/D converter. The 12 bit A/D converter provides a resolution of 1/4095 parts of full scale.

The speed of data gathering is dependent on the method of triggering and data transfer, as the table below illustrates.

A/D CONVERSION SPEED	PC 4.77 MHz	386/20MHz
Polled/ Transfer to variable	320	2,200
Interrupt/ Variable or array	4,000	20,000
D.M.A.	110,000	110,000

I/O & CONTROL REGISTER MAP - DAS1400

The CIO-DAS1400 has an additional set of registers at base address plus 400 HEX, for a complete discussion of the addressing scheme that makes this possible, please see the CIO-DAS1600 data sheet. The additional registers for the CIO-DAS1400 are the same as the CIO-DAS1600 with of course the exception of the 8255 control and I/O registers. The CIO-DAS1400 does not have the additional 8255 as does the CIO-DAS1600.

CIO-DAS1400 BURST MODE

For a complete discussion of Burst Mode, Please turn to the CIO-DAS1600 data sheet. The CIO-DAS1400 is a cut down, analog input only version of the CIO-DAS1600. As such, all CIO-DAS1600 analog input functions are supported. The burst mode is among those. Note: The CIO-DAS16/Jr does NOT support burst mode.

NOW!   CIO-DAS16Jr. + CIO-CTR05

One of our customers called and just had to have it! "Please combine a CIO-DAS16Jr and a CIO-CTR05 on one board" he asked. WE DID and we're offering this board to all our customers who have applications calling for high speed analog input and complex counter-timers.

The CIO-DAS16JR/CTR multifunction analog, digital I/O and counter board is a 100% compatible with the DAS-16G and CTM-05 (MetraByte). For complete information on this board, see the catalog pages for CIO-DAS16Jr and CIO-CTR05; or call technical support.

CIO-DAS16JR/CTR with complete CTR05 with separate base address and 37 pin connector. 100% compatible!
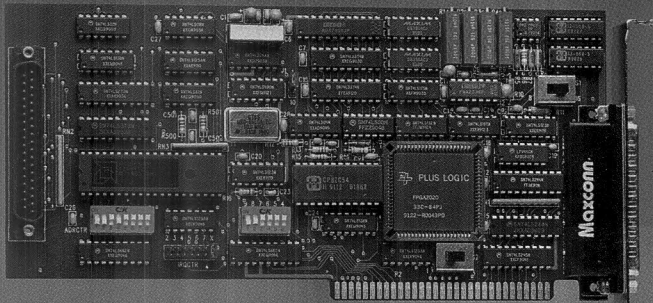
I/O & CONTROL REGISTER MAP - DAS16/Jr

The CIO-DAS16Jr. and MetraByte DAS-16 are 100% software compatible because the I/O register have identical functions on each board. I/O registers are the locations to which the computer writes and reads commands, status and data to and from. The first 16 registers of the CIO-DAS16/330 share these register functions.

I/O ADDR.	CIO-DAS16Jr. FUNCTION R/W	I/O ADDR.	CIO-DAS16Jr. FUNCTION R -/W
BASE + 0	A/D Low Byte / Start A/D	BASE + 8	A/D Status / NA
BASE + 1	A/D High Byte / NA	BASE + 9	Control Settings / Control
BASE + 2	Mux Settings / Mux Scan Control	BASE + 10	NA / Counter Source Control
BASE + 3	Digital 4 In / Digital 4 Out	BASE + 11	Gain & Range
BASE + 4	Not Used: These 4 registers are the	BASE + 12	Counter 0 / Counter 0 Load
BASE + 5	DAS-16 D/A control registers, and	BASE + 13	Counter 1 / Counter 1 Load
BASE + 6	are not used so that existing DAS-	BASE + 14	Counter 2 / Counter 2 Load
BASE + 7	16 software will be compatible.	BASE + 15	NA / 8254 Counter Control

GAIN & RANGE SELECTION - CIO-DAS16/Jr

No need to set switches to select an analog input range. The analog input range is fully programmable. A single write to Base + 11 controls both the unipolar/bipolar setting and the amplification of the analog input signal. The gain register, located at the board's Base + 11 address, is an eight bit register. The lower four bits control the gain and range.

$D7$	$D6$	$D5$	$D4$	$D3$	$D2$	$D1$	$D0$
X	X	X	X	Range	U/B	G1	G0

RANGE = The A/D chip input range, either 10V full scale or 20V full scale. 0 = 10V, 1 = 20V.
U/B = Unipolar or Bipolar ranges. 0 = Bipolar, 1 = Unipolar.
G1 G0 = the gain of the input amplifier. 0,0 = X1. 0,1 = X2. 1,0 = X4. 1,1 = X8.
Ranges are: 0-10V, 0-5V, 0-2.5V, 0-1.25V, 0-0.625V
and   +/-10V, +/-5V, +/-2.5V, +/-1.25V, +/-0.625V

GAIN & RANGE SELECTION - CIO-DAS1400

The analog input range of the CIO-DAS1400 is partially programmable. Like the CIO-DAS1600, the Unipolar/Bipolar choice is made by setting a switch. Two versions of the CIO-DAS1400 provide two different ranges.

Ranges available are, by product are:

CIO-DAS1401	0-10V, 0-1V, 0-0.1V, 0-0.01V
	+/-10V, +/-1V, +/-0.1V, +/-0.01V
CIO-DAS1402	0-10V, 0-5V, 0-2.5V, 0-1.25V
	+/-10V, +/-5V, +/-2.5V, +/-1.25V

A/D SPECIFICATIONS

Analog to Digital Resolution	12 Bit, 1 part in 4096
Channels	16 SE or 8 Differential
A/D Type	Successive Approx. ADS 7800
Conversion Time	3 uS
A/D Convert & Transfer Speed	110KHz
Accuracy	0.01% +/- 1 LSB
Integral Linearity	+/- 1 LSB
No missing codes over temp. range.	
Maximum Overvoltage	+/- 35V Continuous
Input Leakage Current	250 nA Max @ 25°C
Gain Drift	+/- 25 ppm/Deg C Max
Zero Drift	+/- 10 ppm/Deg C Max
GAIN & RANGE	
CIO-DAS16/Jr	0-10V, 0-5V, 0-2.5V, 0-1.25V,+/-10V, +/-5V, +/-2.5V, +/-1.25V, +/-0.625V
CIO-DAS1401	0-10V, 0-1V, 0-0.1V, 0-0.01V +/-10V, +/-1V, +/-0.1V, +/-0.01V
CIO-DAS1402	0-10V, 0-5V, 0-2.5V, 0-1.25V +/-10V, +/-5V, +/-2.5V, +/-1.25V

CIO-DAS08-AO

Medium Speed, 8 Channel Analog Input, 2 Analog Output, 3 Counters, 31 Digital I/O

DUAL 12 BIT D/A

A/D CONVERTER12 BIT (1/4095)
574 = 40KHz MAX, 20 MHz 386 =
20 KHz

8 DIFFERENTIAL OR
SINGLE ENDED
ANALOG INPUTS
2 ANALOG OUTPUTS

82C55 DIGITAL I/O
CIO-DIO24
COMPATIBLE,
24 TTL I/O LINES

USE BP40-37
FOR 40 PIN TO
37 PIN D
CONNECTOR
CIO-DIO24
COMPATIBLE

37 PIN D CONNECTORDAS-
08 FAMILY COMPATIBLE

BASE ADDRESS SWITCH

8254 , THREE 16 BIT COUNTER/TIMER

INSTALLS IN PC/XT/AT/X86/PS30
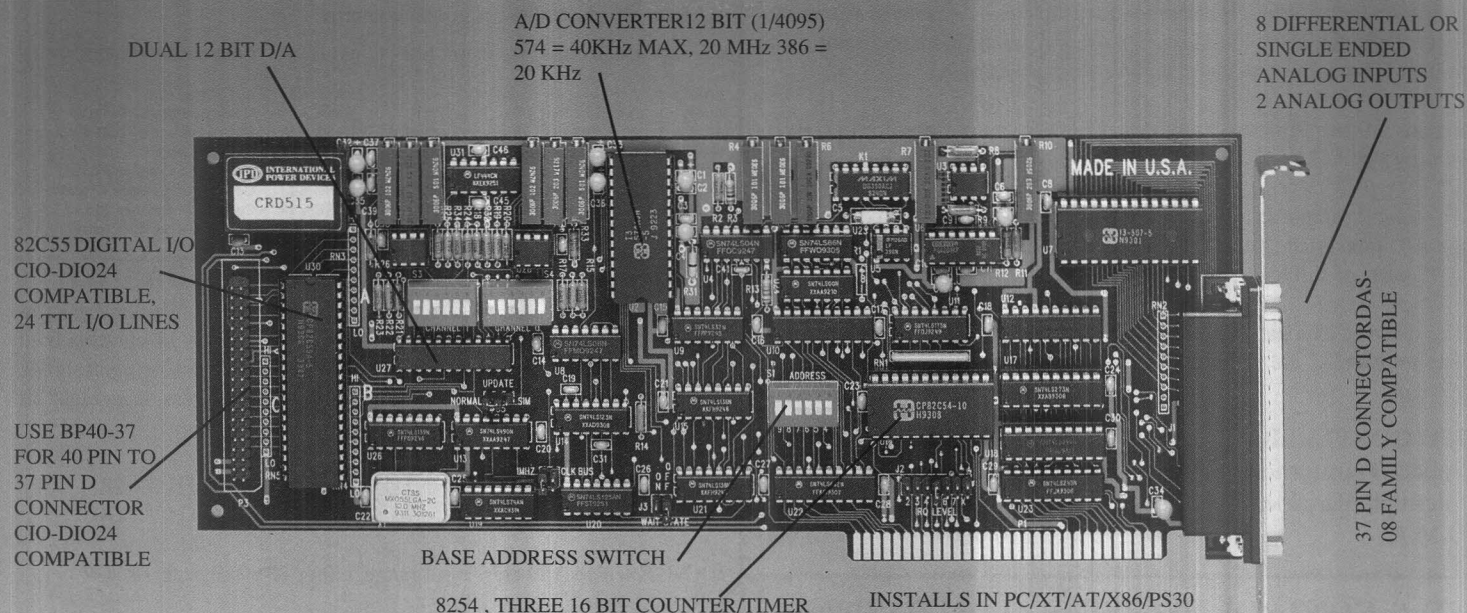
DESCRIPTION

The CIO-DAS08AO multifunction analog and digital I/O board is designed to be compatible with the DAS08 and DAS08-PGA while adding two analog output channels. The CIO-DAS08AO provides every polpular laboratory I/O function on a single low cost board.

The CIO-DAS08AO is supported by a broad range of software to allow programmed control in BASIC, C, FORTRAN and PASCAL. Many menu controlled data logging, analysis and control programs are available from a number of third party developers. In fact, any software designed for the popular DAS-08 will work with the CIO-DAS08AO.

The ComputerBoards CIO-DAS08AO comes with an additional 24 bits of digital I/O which is lacking on other manufacturers version of the DAS-08AO.

8 ANALOG INPUTS

The analog signals of the CIO-DAS08-AO are brought on board by a standard 37 pin 'D' type connector directly to an analog multiplexor. The multiplexor provides 8 channels of differential input and is protected against 30 volts max.

A 2 uSec sample & hold captures the signal which is converted by a 574 A/D converter. The 12 bit A/D converter provides a resolution of 1/4095 parts of full scale. A programmable gain amplifier accepts bipolar and unipolar voltages in a number of ranges. Three different configurations of the programmable gain amp are available and are designated by the part number you order.

The CIO-DAS08-AOM has gains and responds to gains codes which are directly compatible to MetraByte's DAS-08AO.

The CIO-DAS08-AOH (for *high* gains) has the same gain codes and ranges as the CIO-DAS08-PGH. These are:
+/-10V, +/-5V, +/-1V, +/-0.5V, +/-0.1V, +/- 0.05V, +/-0.01V, +/-0.005V
0-10V, 0-1V, 0-0.1V, 0-0.01V

The CIO-DAS08-AOL (for *low* gains) has the same gain codes and ranges as the CIO-DAS08-PGL. These are:
+/-10V, +/-5V, +/-2.5V, +/-1.25V, +/-0.625V
0-10V, 0-5V, 0-2.5V, 0-1.25

2 ANALOG OUTPUTS

Two independent 12 bit analog outputs supply voltage in several of either bipolar or unipolar ranges. A bank of switches associated with each D/A select the output voltage range. D/A outputs are voltage only. For current output D/A, please see the CIO-DAC02 or CIO-DAC16I

Output ranges available are: +/-10V, +/-5V, +/-2.5, 0-10V, 0-5V

20KHz A/D or D/A

Using the crystal controlled 8254 pacer clock circuit and either polled or interrupt service routines, input and output update rates of up to 20,000 samples per second may be achieved. The speed of data transfer is dependent on the method of triggering and data transfer, and the CPU speed as the table below illustrates. The rates shown below are typical of a PC with a 16MHz or faster 386 or 486 CPU.

METHOD	CONVERSION SPEED	
	A/D	D/A
Polled/ Transfer to variable	2,000	2,000
Interrupt/ Variable or array	20,000	20,000

COUNTER TIMER

An 8254 counter/timer chip on the CIO-DAS08-AO provides a means to generate pulses, count events, measure frequency and pace the analog input trigger.

The 8254 chip has three 16 bit counters arranged as a CLK input, a Gate which allows or inhibits the CLK input and an OUT, the pulse rate of which is a function of the divisor and the mode of operation. Signals with a frequency of up to 10MHz and of any wave shape may be connected to the CLK input. The only constraint is that the signal be between 0 and 5 volts and cross the 2.4V TTL threshold.

TRIGGERING

A Trigger is the event that begins an acquisition/transfer cycle. There are three ways to trigger a CIO-DAS08-AO; software, internal or external. There are two ways to transfer data from the CIO-DAS08-AO; program or interrupt service routine.

An internal trigger is useful for synchronizing samples to a known time base, such as the on board 8254 programmable divider and PC Bus Peripheral Clock signal . Using an external trigger allows you to synchronize samples to an external event.

CONTROL REGISTERS

The CIO-DAS08AO is software compatible with the DAS08 because the I/O register have identical functions on each board. I/O registers are the locations which the computer writes commands and data to and reads status and data from.

I/O ADDR.	FUNCTION R | W	I/O ADDR.	FUNCTION R | W
BASE + 0	A/D Low Byte | Start 8 Bit A/D	BASE + 8	DAC0 Low Byte
BASE + 1	A/D High Byte | Start 12 Bit A/D	BASE + 9	DAC0 High Byte
BASE + 2	Mux Settings | Mux Scan Control	BASE + 10	DAC 1 Low Byte
BASE + 3	Gain & Range Control | Status	BASE + 11	DAC 1 High Byte
BASE + 4	Read Counter 0 | Load Counter 0	BASE + 12	Port A In | Port A Out
BASE + 5	Read Counter 1 | Load Counter 1	BASE + 13	Port B In | Port B Out
BASE + 6	Read Counter 2 | Load Counter 2	BASE + 14	Port C In | Port C Out
BASE + 7	Not Used | Counter Control	BASE + 15	NA | 8255 Control

CIO-DAS08-AO CONNECTOR

The connector pin assignment of the CIO-DAS08-AO mirror those of the MetraByte DAS-08AO, which are quite similar to the CIO-DAS08 and CIO-DAS08-PGA. Intentionally, members of the DAS-08 family of boards may be substituted without requiring changes to field wiring.

The Analog inputs may be fully differential (factory default) or referenced to ground through 10K resistors. A position for a 10K resistor SIP is supplied on the board.

Ch 0 Low	19		37	Ch 0 High
Ch 1 Low	18		36	Ch 1 High
Ch 2 Low	17		35	Ch 2 High
Ch 3 Low	16		34	Ch 3 High
Ch 4 Low	15		33	Ch 4 High
Ch 5 Low	14		32	Ch 5 High
Ch 6 Low	13		31	Ch 6 High
Ch 7 Low	12		30	Ch 7 High
L.L. Gnd	11		29	PC Bus +5
OP4	10		28	Digital Gnd
OP3	9		27	IP3
OP2	8		26	IP2
OP1	7		25	IP1
OUT 2	6		24	IR Input
OUT 1	5		23	Gate 2
CLK 1	4		22	Gate 1
OUT 0	3		21	Gate 0
CLK 0	2		20	-12V
+12V	1			

VIEW FROM REAR OF PC
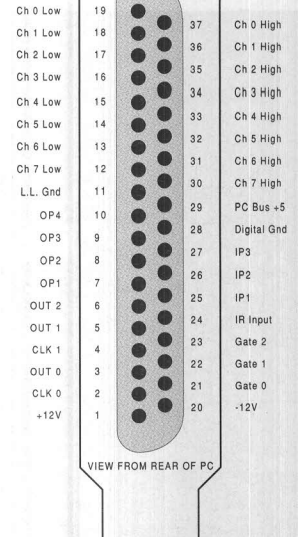
24 DIGITAL I/O

The CIO-DAS08AO provides 24 lines of bidirectional (82C55) digital I/O through a 40 pin header connector mounted on the rear of the board. The digital lines may be connected to directly or brought to the rear of the PC with a BP40-37. When brought to a 37 pin connector through the BP40-37, the connector pin-out is identical to that of a CIO-DIO24.

If you wish to see an illustration or photo of the BP40-37 cable, please see the CIO-DAS1600 data sheet.

GND	19		37	Port A0
+5V	18		36	Port A1
GND	17		35	Port A2
+12V	16		34	Port A3
GND	15		33	Port A4
-12V	14		32	Port A5
GND	13		31	Port A6
-5V	12		30	Port A7
GND	11		29	Port C0
Port B0	10		28	Port C1
Port B1	9		27	Port C2
Port B2	8		26	Port C3
Port B3	7		25	Port C4
Port B4	6		24	Port C5
Port B5	5		23	Port C6
Port B6	4		22	Port C7
Port B7	3		21	PC Bus GND
No Connect	2		20	PC Bus +5
No Connect	1			

VIEW FROM REAR OF PC

SPECIFICATIONS

ANALOG INPUT

A/D Resolution	12 Bits
Channels	8 Differential
AOH Ranges	See Chart
Coversion Speed	25uS
Linearity	+/-1 Bit
Zero Drift	20 ppm /Deg C
Gain Drift	35 ppm /Deg C
Input Impedence	>100M ohm

DIGITAL I/O

Out Only	4 Bits
In Only	3 Bits
Type	LSTTL
Out or In	24 Bits
Type	CMOS TTL
Source/Sink	3mA

ENVIRONMENTAL

Operating Temp	0 to 50 Deg C
Storage Temp	-20 to 70 Deg C
Humidity	0-95% Non Cond.

ANALOG OUTPUT

D/A Resolution	12 Bits
Channels	2
Ranges	See Chart
Settling Time	4uS FS
Output Current	+/-5mA
Output Resistance	< 0.1 Ohm

COUNTER/ TIMER

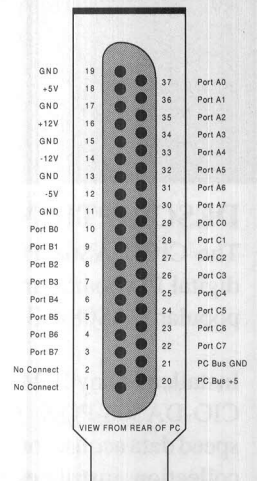|	
Type	8254
Channels	3 Down Count
Counter Size	16 Bit
Max Input	10MHz
XTAL Osc.	1 or 10 MHz

POWER CONSUMPTION

5V	1200mA Max
+/-12V	Not Used
+/-15V	Supplied by DC/DC

ORDERING GUIDE

CIO-DAS08AO multifunction A/D board.

Gains of 1, 10, 100, 1000	CIO-DAS08-AOH
Gains of 1, 2, 4, 8	CIO-DAS08-AOL
Gain codes identical to MetraByte DAS-08AO	CIO-DAS08-AOM
8 Position Isolation Module Rack for A/D Inputs	ISO-RACK08
24 Position Solid State Relay Rack for 24 DIO	SSR-RACK24
Analog Multiplexor, Thermocouple & CJC	
32 Ch. Diff. Input, 2 Gains, up to 4 per CIO-DAS08.	CIO-EXP32
16 Ch. Diff. Input, 1 Gain, up to 8 per CIO-DAS08.	CIO-EXP16
Screw Terminal Boards	
16" X 4" all signals from one 37 D plus proto area.	CIO-TERMINAL
4" X 4" all signals from one 37 D connector.	CIO-MINI37
16" X 4" all signals from one 37D, Spade Lug Terminals.	CIO-SPADE50
6" X 4" identical to MetraByte STA-08.	CIO-STA08
Cables	
40 Pin Header to 37 Pin D with Backplate for 24 DIO	BP40-37
2 foot ribbon cable, 37 conductor, female connectors.	C37FF-2
'N' foot ribbon cable, 37 conductor, female connectors.	C37FF-##
5 foot shielded cable, female connectors, 37 cond.	C37FFS-5
10 foot shielded cable, female connectors, 37 cond.	C37FFS-10

CIO-DAS08-PGH & PGL

Medium Speed, 8 Channel Programmable Gain Analog Input, 3 Counters, 7 Digital I/O

DC/DC SUPPLIES +/-15V
TO ANALOG CIRCUIT

A/D CONVERTER 12 BIT (1/4095)
574 = 40KHz MAX. IN A 20MHz 386 IS
20KHz ATTAINABLE THROUGHPUT

PROGRAMMABLE GAINS OF:
PGH = 0.5, 1, 10, 50, 100, 500, 1000
PGL = 0.5, 1, 2, 4, 8

8 ANALOG INPUTS
DIFFERENTIAL OR
SINGLE ENDED.
3, 16 BIT COUNTERS
3 DIGITAL IN
4 DIGITAL OUT

PROGRAMMABLE
RANGES:
PGH =
+-/10, +/-5, +/-1
+/-0.5, +/-0.1
+/-0.05, +/-0.01
+/-0.005
0-10, 0-1, 0-0.1
0-0.01
PGL =
+/-10, +/-5, +/-2.5
+/-1.25, +/-0.625
0-10, 0-5, 0-2.5
0-1.25
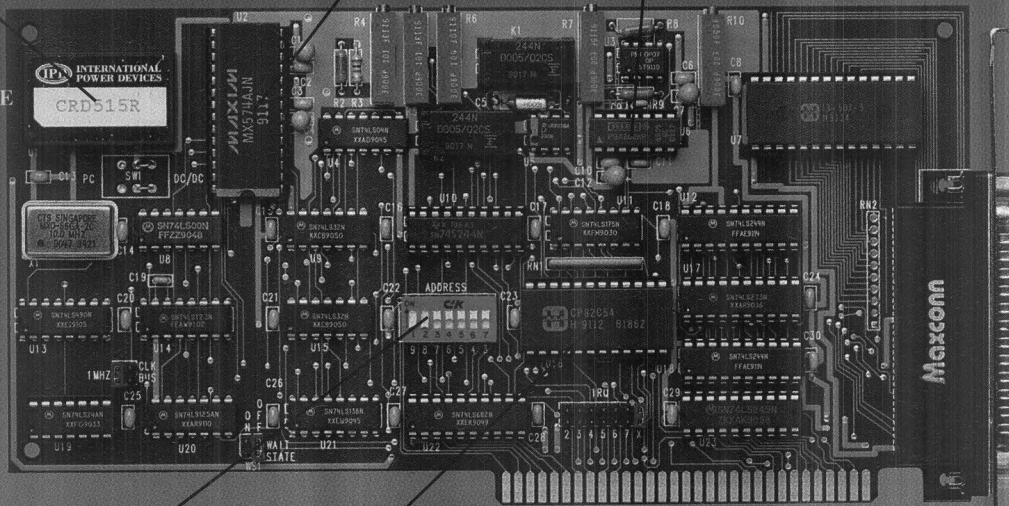
37 PIN CONNECTOR

BASE ADDRESS SWITCH

8254, THREE 16 BIT COUNTER/TIMER

INSTALLS IN PC/XT/AT/386

DESCRIPTION

The CIO-DAS08-PGH, PGL & PGM multifunction analog and digital I/O boards are designed to be compatible with MetraByte's popular DAS08-PGA.

Installed in any IBM PC/XT/AT/PS30 or compatible computer the CIO-DAS08-PGX turns your personal computer into a medium speed data acqusition and control station suitable for laboratory data collection, instrumentation, production test, or industrial monitor-ing. The inputs of the board may be differential or single ended and the connector pin-out is identical to that of the CIO-DAS08. Accessory boards, screw terminal and cables are interchangeable.

The CIO-DAS08-PGX is supported by a wide range of application programs, language libraries and includes software for installation, calibration, test and a simple to use data acquisition program.
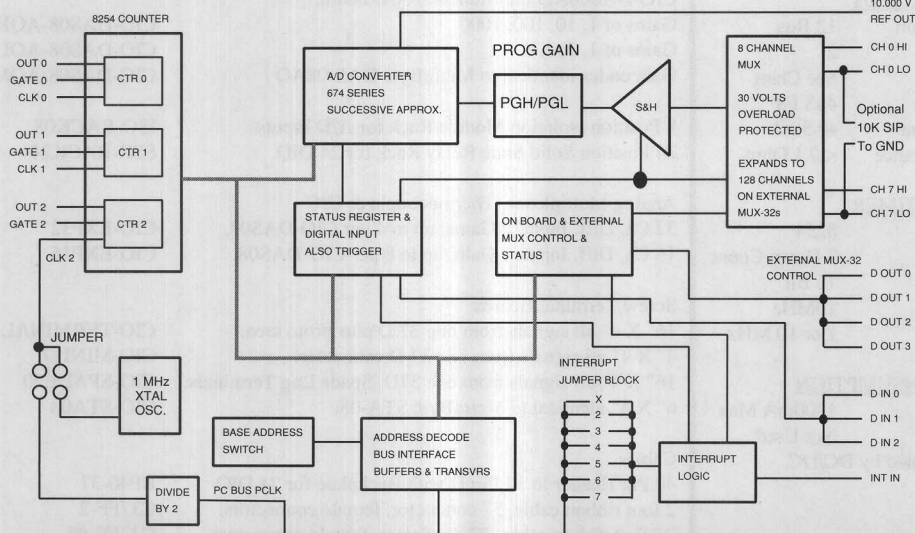
CIO-AD08-PGA ANALOG CONNECTOR

CH0 LO 19	37 CH0 HIGH
CH1 LO 18	36 CH1 HIGH
CH2 LO 17	35 CH2 HIGH
CH3 LO 16	34 CH3 HIGH
CH4 LO 15	33 CH4 HIGH
CH5 LO 14	32 CH5 HIGH
CH6 LO 13	31 CH6 HIGH
CH7 LO 12	30 CH7 HIGH
LLGND 11	29 +5 VOLTS
DIGITAL OUT 4 10	28 DIG GND
DIGITAL OUT 3 9	27 DIGITAL IN 3
DIGITAL OUT 2 8	26 DIGITAL IN 2
DIGITAL OUT 1 7	25 DIGITAL IN 1
COUNTER 2 OUT 6	24 INTERRUPT INPUT
COUNTER 1 OUT 5	23 GATE 2
COUNTER 1 IN 4	22 GATE 1
COUNTER 0 OUT 3	21 GATE 0
COUNTER 0 IN 2	20 -12V PC BUS
+12 PC BUS 1	

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A/D CONVERSION SPEED TRIGGER/TRANSFER	CLOCK PC 4.77 MHz	CLOCK 386/20MHz
Polled/ Transfer to variable	320	2,200
Interrupt/ Variable or array	4,000	20,000

A/D SPECIFICATIONS

Resolution	12 Bit, 1 part in 4096
Channels	8 Differential or Single Ended
A/D Type	Successive Approx. AD574
Conversion Time	20 uS
Accuracy	0.01% +/- 1 LSB
Integral Linearity	+/- 1 LSB
No missing codes guaranteed over temp. range.	
Maximum Overvoltage	+/- 35V Continuous
Input Leakage Current	250 nA Max @ 25°C
Gain Drift	+/- 25 ppm/Deg C Max
Zero Drift	+/- 10 ppm/Deg C Max

PGH GAIN	Bipolar Range (+/_V)	Unipolar Range (V)
0.5	10	X
1	5	10
5	1	X
10	0.5	1
50	0.1	X
100	0.05	0.1
500	0.01	X
1000	0.005	0.01
PGL GAINS		
0.5	10	N/A
1	5	10
2	2.5	5
4	1.25	2.5
8	0.625	1.25

I/O & CONTROL REGISTER MAP

The CIO-DAS08-PGM and MetraByte DAS-08PGA are software compatible because the I/O register have identical functions on each board. I/O registers are the locations which the computer writes commands and data to and reads status and data from. The CIO-DAS08-PGL is also fully compatible with the DAS-8PGA except for the gain/range register. That register produces different gains because the gains of the CIO-DAS08-PGL are 1,2,4,&8. Read more about the PGL elsewhere.

I/O ADDR.	CIO-DAS08-PGH FUNCTION R | W
BASE + 0	A/D Low Byte | Start 8 Bit A/D
BASE + 1	A/D High Byte | Start 12 Bit A/D
BASE + 2	Mux Settings | Mux Scan Control
BASE + 3	Gain & Range Control
BASE + 4	Read Counter 0 | Load Counter 0
BASE + 5	Read Counter 1 | Load Counter 1
BASE + 6	Read Counter 2 | Load Counter 2
BASE + 7	Not Used | Counter Control

The L in PGL stands for Low gains.

CIO-DAS08-PGM

The gain codes and ranges of the CIO-DAS08-PGM are identical to those of the MetraByte DAS08-PGA. If you need total software compatibility with an existing DAS08-PGA installation, select this model number, otherwise, we recommend the PGH or PGL gains as more flexible.

COUNTER TIMER

An 8254 counter/timer chip on the CIO-DAS08-PGH provides a means to generate pulses, count events, measure frequency and pace the analog input trigger.

The 8254 chip has three 16 bit counters arranged as a CLK input, a Gate which allows or inhibits the CLK input and an OUT, the pulse rate of which is a function of the divisor and the mode of operation.

CLK Input Freq . . . . . .   10 MHz Max
TTL Loads . . . .   Source 1, Sink 4
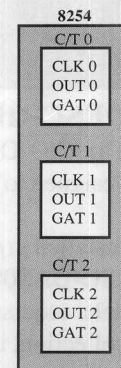
8254

C/T 0
CLK 0
OUT 0
GAT 0

C/T 1
CLK 1
OUT 1
GAT 1

C/T 2
CLK 2
OUT 2
GAT 2

TRIGGERING

A Trigger is the event that begins an acquisition/transfer cycle. There are three ways to trigger a CIO-DAS08-PGH; software, internal or external. There are two ways to transfer data from the CIO-DAS08-PGH; program or interrupt service routine.

ORDERING GUIDE

8Ch A/D, 7DIO, 3 CTR, DECIMAL GAINS 1,10,100,500.	CIO-DAS08-PGH
8 Ch A/D, 7 DIO, 3 CTR, BINARY GAINS 1,2,4,8	CIO-DAS08-PGL
8 Ch A/D, 7 DIO, 3CTR, MetraByte DAS08-PGA Gains	CIO-DAS08-PGM

Analog Multiplexor, Thermocouple & CJC

32 Ch. Diff. Input, 2 Gains, up to 4 per CIO-AD08.	CIO-EXP32
16 Ch. Diff. Input, 1 Gain, up to 8 per CIO-AD08.	CIO-EXP16
8 Channel Isolation Module Rack	ISO-RACK08

Screw Terminal Boards

16" X 4" all signals from one 37 D plus proto area & circuitry.	CIO-TERMINAL
4" X 4" all signals from one 37 D connector.	CIO-MINI37
16" X 4" all signals from one 37D, Spade Lug Terminals.	CIO-SPADE50

Cables

2 foot ribbon cable, 37 conductor, female connectors.	C37FF-2
'N' foot ribbon cable, 37 conductor, female connectors.	C37FF-N
5 foot shielded cable, molded female connectors, 37 cond.	C37FFS-5
10 foot shielded cable, molded female connectors, 37 cond.	C37FFS-10

CIO-DAS08

Medium Speed, 8 Channel Analog Input, 3 Counters, 31 Digital I/O

ANALOG INPUT RANGES
+/- 5 V,
+/- 10 V &
0-10 V

8254 , THREE 16 BIT COUNTER/TIMER

A/D CONVERTER 12 BIT (1/4095)
574 = 40KHz MAX, 20 MHz 386 = 20 KHz

GAIN & RANGE
SELECT SWITCH
ACCESSIBLE
FROM OUTSIDE
PC

8255 DIGITAL I/O
100% PIO-12
COMPATIBLE,
24 TTL I/O LINES

8 ANALOG INPUTS
3, 16 BIT COUNTERS
3 DIGITAL IN
4 DIGITAL OUT

37 PIN D
CONNECTOR
PIO-12
COMPATIBLE

37 PIN D
CONNECTOR
100 % DAS-08
COMPATIBLE

BASE ADDRESS SWITCH

INSTALLS IN PC/XT/AT/386/PS30
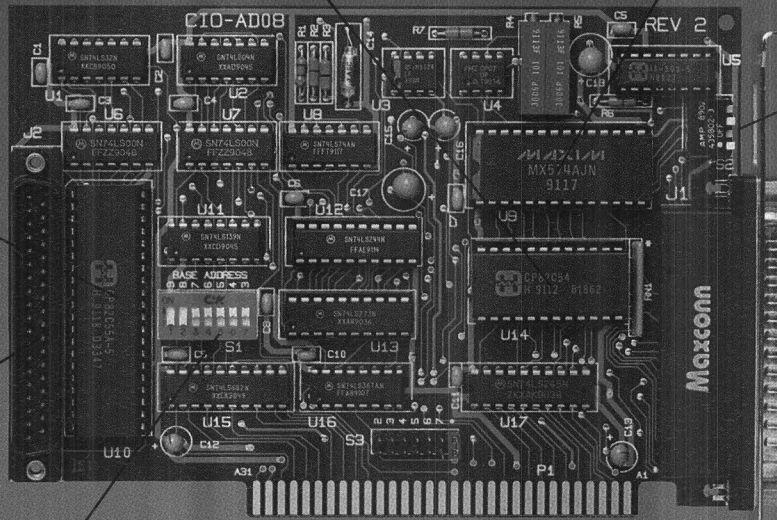
DESCRIPTION

The CIO-DAS08 multifunction analog and digital I/O board is designed to be compatible with MetraByte's popular DAS08

Installed in any IBM PC/XT/AT/PS30 or compatible computer the CIO-DAS08 turns your personal computer into a medium speed data acquisition and control station suitable for laboratory data collection, instrumentation, production test, or industrial monitoring.

The CIO-DAS08 is supported by a broad range of software to allow programmed control in BASIC, C, FORTRAN and PASCAL. Many menu controlled data logging, analysis and control programs are available from a number of third party developers. In fact, any software designed for MetraByte's popular DAS-08 will work with the CIO-DAS08; we guaranty it!

In addition, the CIO-DAS08 comes with a complete PIO-12 compatible 8255 and 37 pin connector!

BLOCK DIAGRAM

RT A 0	8255C 24 BIT PIO-12 TYPE DIGITAL I/O CHIP
RT B 0	
RT C 0	2, 8 BIT & 2, 4 BIT PORTS
RT C 4	LOCATED I/O ADDR BASE + 8

10.000 REF O

NOTE:
ADDITIONAL ANALOG RANGES

+/- 5 VOLTS   STANDARD
+/- 10 VOLTS   SW SELECTABLE
0 - 10 VOLTS   SW SELECTABLE

OFFSET POT

A/D CONVERTER
674 SERIES
SUCCESSIVE APPROX

BIPOLAR / UNIPOLAR IN

RANGE SWITCH

10 V

8 CHANNEL MUX

S&H

30 VOLTS OVERLOAD PROTECTED

EXPANDS TO 128 CHANNELS ON EXTERNAL MUX-32s

CH 0
CH 1
CH 2
CH 3
CH 4
CH 5
CH 6
CH 7

STATUS REGISTER & DIGITAL INPUT ALSO TRIGGER

ON BOARD & EXTERNAL MUX CONTROL & STATUS

D OUT
D OUT
D OUT
D OUT
D IN 0
D IN 1
D IN 2

8254 COUNTER

ON BOARD DATA BUS

OUT 0 / GATE 0 / CLK 0   CTR 0
OUT 1 / GATE 1 / CLK 1   CTR1
OUT 2 / GATE 2   CTR2   CLK 2

DIVIDE BY 2

PC BUS PCLK

BASE ADDRESS SWITCH

ADDRESS DECODE
BUS INTERFACE
BUFFERS & TRANSVRS

INTERRUPT JUMPER BLOCK
X
2
3
4
5
6
7

INTERRUPT LOGIC

INT IN

CIO-DAS08 CONNECTOR

STANDARD DAS-08
+/- 5 VOLT RANGE
SHOWN HERE

OFFSET POT S4 L   S4 R A/D OFFSET
GROUND   S3 L   S3 R A/D OFFSET
ANALOG IN S2 L   S2 R 10 V RANGE A/D IN
ANALOG IN S1 L   S1 R 20 V RANGE A/D IN

+10 .000 VOLT REFERENCE	19		37	CH0 HIGH IN
LOW LEVEL GROUND	18		36	CH 1 HIGH IN
LOW LEVEL GROUND	17		35	CH 2 HIGH IN
LOW LEVEL GROUND	16		34	CH 3 HIGH IN
LOW LEVEL GROUND	15		33	CH 4 HIGH IN
LOW LEVEL GROUND	14		32	CH 5 HIGH IN
LOW LEVEL GROUND	13		31	CH 6 HIGH IN
LOW LEVEL GROUND	12		30	CH 7 HIGH IN
DIGITAL COMMON	11		29	+5 VOLTS PC BUS POWER
DIGITAL OUTPUT 4	10		28	DIGITAL GROUND
DIGITAL OUTPUT 3	9		27	DIGITAL INPUT 3
DIGITAL OUTPUT 2	8		26	DIGITAL INPUT 2
DIGITAL OUTPUT 1	7		25	DIGITAL INPUT 1
COUNTER 2 OUT	6		24	INTERRUPT INPUT
COUNTER 1 OUT	5		23	GATE 2
COUNTER 1 INPUT	4		22	GATE 1
COUNTER 0 OUT	3		21	GATE 0
COUNTER 0 INPUT	2		20	-12 VOLTS PC BUS POWER
+12 VOLTS PC BUS POWER	1			

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ANALOG INPUTS

The analog input section of the CIO-DAS08 has been designed for flexibility and accuracy in a number of configurations and ranges. The analog signals are brought on board by a standard 37 pin 'D' type connector directly to an analog multiplexor. The multiplexor provides 8 channels of single ended input and is protected against 30 volts max.

A 2 uSec sample & hold captures the signal which is converted by a 574 A/D converter. The 12 bit A/D converter provides a resolution of 1/4095 parts of full scale. Please see the gain and range switch configuration diagram to the right.

The speed of data gathering is dependent on the method of triggering and data transfer, as the table below illustrates.

RANGE SELECTION

Three range combinations are provided by selecting options from the gain & range switches, as seen in the diagram to above. Ranges +/- 5v and 0-10 volts provide 2.44 mV per bit; +/-10V range has a resolution of 4.88 mV per bit.

SWITCH	+/-5V	+/-10V	0-10V	NOTE:
S4	R	R	L	Positions other than those shown to the left are undefined and will not produce valid results
S3	L	L	R	
S2	R	L	R	
S1	L	R	L	

TRIGGERING

A Trigger is the event that begins an acquisition/transfer cycle. There are three ways to trigger a CIO-DAS08; software, internal or external. There are two ways to transfer data from the CIO-DAS08; program or interrupt service routine.

An internal trigger is useful for synchronizing samples to a known time base, such as the on board 8254 programmable divider and PC Bus Peripheral Clock signal . Using an external trigger allows you to synchronize samples to an external event.

SPECIFICATIONS

ANALOG INPUT
A/D Resolution	12 Bits
Channels	8 Differential
AOH Ranges	See Chart
Conversion Speed	25uS
Linearity	+/-1 Bit
Zero Drift	20 ppm /Deg C
Gain Drift	35 ppm /Deg C
Input Impedance	>100M ohm

DIGITAL I/O
Out Only	4 Bits
In Only	3 Bits
Type	LSTTL
Out or In	24 Bits
Type	CMOS TTL
Source/Sink	3mA

ENVIRONMENTAL
Operating Temp	0 to 50 Deg C
Storage Temp	-20 to 70 Deg C
Humidity	0-95% Non Cond.

INTERRUPT
Positive Edge Triggered	
PC Bus IRQ	Jumper 2-7
Enable	INTE Cntrl

VREF OUTPUT
+10V +/- 0.1V @ 2mA Max

COUNTER/ TIMER
Type	8254
Channels	3 Down Count
Counter Size	16 Bit
Max Input	10MHz
XTAL Osc.	1 or 10 MHz

POWER CONSUMPTION
5V	180mA Max
+12V	10mA Max
-12V	16mA Max

24 BIT DIGITAL I/O CONNECTOR

A 37 Pin D type connector, mounted on the CIO-DAS08 board is the connector for a PIO-12 compatible 24 line bi-directional digital I/O port. The 8255 on board raises the digital I/O count to 32 lines. The 8255 BASE address is located at CIO-DAS08 BASE address + 8. To access the 8255 from a menu driven program just install a PIO-12 at CIO-DAS08 BASE + 8.
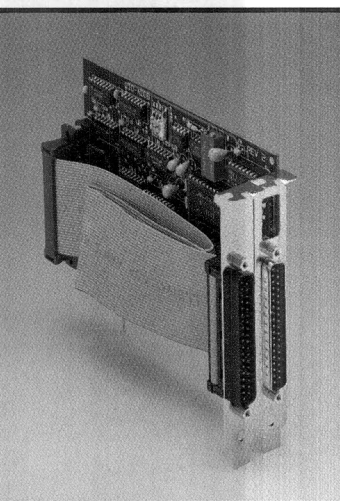
GND 19	37 PA0
+ 5 V 18	36 PA1
GND 17	35 PA2
+12 V 16	34 PA3
GND 15	33 PA4
-12 V 14	32 PA5
GND 13	31 PA6
-5 V 12	30 PA7
GND 11	29 PC0
PB0 10	28 PC1
PB1 9	27 PC2
PB2 8	26 PC3
PB3 7	25 PC4
PB4 6	24 PC5
PB5 5	23 PC6
PB6 4	22 PC7
PB7 3	21 GND
NC 2	+ 5V
NC 1	

PORT A, PORT B, PORT C

Connect external digital signals to the CIO-DAS08 using a 37 pin connector and cable (#C37FF-2) or a 37 pin connector and cable attached to a 37 pin male connector mounted in a backplate; BP37.

I/O & CONTROL REGISTER MAP

The CIO-DAS08 and MetraByte DAS-08 are software compatible because the I/O register have identical functions on each board. I/O registers are the locations which the computer writes commands and data to and reads status and data from.

I/O ADDR.	CIO-DAS08 FUNCTION R	W
BASE + 0	A/D Low Byte | Start A/D
BASE + 1	A/D High Byte | NA
BASE + 2	Mux Settings | Mux Scan Control
BASE + 3	Not Used
BASE + 4	Read Counter 0 | Load Counter 0
BASE + 5	Read Counter 1 | Load Counter 1
BASE + 6	Read Counter 2 | Load Counter 2
BASE + 7	Not Used | Counter Control
BASE + 8	Port A In | Port A Out
BASE + 9	Port B In | Port B Out
BASE + 10	Port C In | Port C Out
BASE + 11	NA | 8255 Control

Address 300H shown

	SW	HEX
	A9	200
	A8	100
	A7	80
	A6	40
	A5	20
	A4	10
	A3	8

9 8 7 6 5 4 3
↓ ↓ ↑ ↑ ↑ ↑ ↑
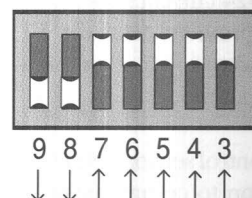
ORDERING GUIDE

CIO-DAS08 multifunction A/D board.

8 Ch A/D, 31 DIO, 3 CTR50	CIO-DAS08

Analog Multiplexor, Thermocouple & CJC

32 Ch. Diff. Input, 2 Gains, up to 4 per CIO-DAS08.	CIO-EXP32
16 Ch. Diff. Input, 1 Gain, up to 8 per CIO-DAS08.	CIO-EXP16

Screw Terminal Boards

16" X 4" all signals from one 37 D plus proto area & circuitry.	CIO-TERMINAL
4" X 4" all signals from one 37 D connector.	CIO-MINI37
16" X 4" all signals from one 37D, Spade Lug Terminals.	CIO-SPADE50
6" X 4" identical to MetraByte STA-08.	CIO-STA08

Cables

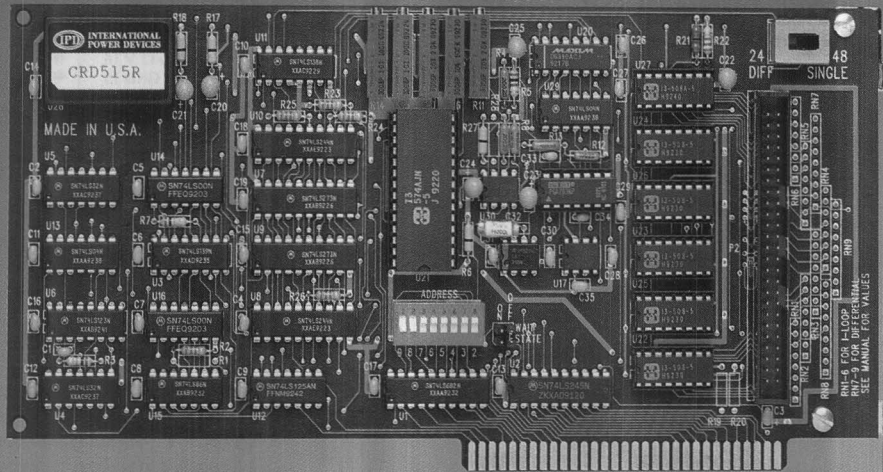|	
2 foot ribbon cable, 37 conductor, female connectors.	C37FF-2
'N' foot ribbon cable, 37 conductor, female connectors.	C37FF-N
5 foot shielded cable, molded female connectors, 37 cond.	C37FFS-5
10 foot shielded cable, molded female connectors, 37 cond.	C37FFS-10

CIO-DAS48-PGA

48 Channel, 12 Bit Analog Input Board. Voltage Input with Programmable Gain or Full 12 Bit 4-20mA.

FULL 12 BIT RESOLUTION IN BOTH VOLTAGE and CURRENT RANGES

High Density, Voltage or Current

Designed for low speed, high density analog measurement, the CIO-DAS48 is especially suited for 4-20mA readings. The analog inputs may be configured as 48 single ended voltage, 24 differential voltage or 24 current sensing inputs. Installing resistor SIPs in the positions provided near the 50 pin header connector modify the input circuitry to work in one of the single ended, differential or current input modes.

Process control sensors with built in sending units often use 4-20mA current loop to communicate with the data acquisition system; a computer or programmable controller. Current loop transmission is noise immune. Electromechanical disturbances and RFI from AC voltage sources will not affect the signal level of a 4-20mA current loop. Noise immunity makes 4-20mA desirable in factory environments.

Most data acquisition boards are designed for voltage input only. They can easily be converted to current input with a shunt resistor but lose resolution in the process. For example, a 0-5V input may be converted to 0-20mA by placing a 250 Ohm precision resistor across the inputs (E/I=R, or, 5/0.02 = 250). If a 4-20mA loop is being monitored, 20% of the resolution is lost because the range 0-4mA is unused.

When installed, the current conversion SIPs provide full 12 bit resolution over the range 4-20mA.

The analog input circuit contains a programmable amplifier so the input range is under software control. Both voltage and current input ranges are programmable and although four current input ranges are available, it is likely that the 4-20mA range is the one you are interested in.

I/O Connector and Cabling

A single 50 pin connector provides the interface to cables and screw terminal boards. The connector is a standard Amp 0.10" spacing header connector.

The inputs are arranged so that in differential mode channel high and channel low run side by side on the cable. In single ended mode each pin acts as an independent analog input. Pins 49 and 50 provide reference to low level ground, a requirement for both differential & single ended inputs.

A screw terminal, the CIO-MINI50, provides 12-20 AWG jaw-clamp type screw terminals on a 4"X4" board supplied with 1/2" stand-offs. The CIO-MINI50 employs the same 50 pin male header as the CIO-DAS48.

Order cable C50FF-2 or custom lengths up to 10 feet to connect the CIO-DAS48 and CIO-MINI50 together.

Of course, you may eliminate the screw terminal board and direct wire signals to the CIO-DAS48 through a ribbon cable terminated with a 50 pin connector.

Left Signal	Pin		Pin	Right Signal
LLGND	50		49	LLGND
CH 47 HI / CH 23 LOW	48		47	CH HI 23
CH 46 HI / CH 22 LOW	46		45	CH HI 22
CH 45 HI / CH 21 LOW	44		43	CH HI 21
CH 44 HI / CH 20 LOW	42		41	CH HI 20
CH 43 HI / CH 19 LOW	40		39	CH HI 19
CH 42 HI / CH 18 LOW	38		37	CH HI 18
CH 41 HI / CH 17 LOW	36		35	CH HI 17
CH 40 HI / CH 16 LOW	34		33	CH HI 16
CH 39 HI / CH 15 LOW	32		31	CH HI 15
CH 38 HI / CH 14 LOW	30		29	CH HI 14
CH 37 HI / CH 13 LOW	28		27	CH HI 13
CH 36 HI / CH 12 LOW	26		25	CH HI 12
CH 35 HI / CH 11 LOW	24		23	CH HI 11
CH 34 HI / CH 10 LOW	22		21	CH HI 10
CH 33 HI / CH 9 LOW	20		19	CH HI 9
CH 32 HI / CH 8 LOW	18		17	CH HI 8
CH 31 HI / CH 7 LOW	16		15	CH HI 7
CH 30 HI / CH 6 LOW	14		13	CH HI 6
CH 29 HI / CH 5 LOW	12		11	CH HI 5
CH 28 HI / CH 4 LOW	10		9	CH HI 4
CH 27 HI / CH 3 LOW	8		7	CH HI 3
CH 26 HI / CH 2 LOW	6		5	CH HI 2
CH 25 HI / CH 1 LOW	4		3	CH HI 1
CH 24 HI / CH 0 LOW	2		1	CH HI 0

The speed of data gathering is dependent on the CPU speed but in general may not exceed 20KHz on a fast 386 or 486 computer.

A/D conversions are initiated by a software trigger (write to Base + 1). The conversions may be paced by the personal computer system clock or the timer you have created under program control.

The CIO-DAS48-PGA is not designed for applications such as spectrum analysis or any signal analysis requiring precise sample intervals generated by an on-board pacer clock.

The CIO-DAS48-PGA is best utilized in process control or other applications where the A/D samples are initiated under program control.

Analog Input Ranges

The CIO-DAS48-PGA input range may be programmed as bipolar or unipolar in any of 5 ranges (0.5, 1, 2, 4 & 8). Given the A/D converter's standard +/-5V input range, this translates to input ranges of:

Gain	Bipolar	Unipolar	Unipolar Current
0.5	+/-10 V	N/A	N/A
1	+/-5 V	0 - 10 V	4-20 mA
2	+/-2.5 V	0 - 5 V	2-10 mA
4	+/-1.25 V	0 - 2.5 V	1-5 mA
8	+/-0.625 V	0 - 1.25 V	0.5-2.5 mA

SPECIFICATIONS

A/D Resolution	12 Bits
Channels	24 Differential (Voltage)
	48 Single Ended (Voltage)
	24 Current Input
Programmable Ranges	
Bipolar (Volts)	+/-10, +/-5, +/-2.5, +/-1.25, +/-0.625
Unipolar (Volts)	0-10, 0-5, 0-2.5, 0-1.25
Current (mA)	4-20, 2-10, 1-5, 0.5-2.5
Conversion Speed	25uS
Linearity	+/-1 Bit
Zero Drift	20 ppm /Deg C
Gain Drift	35 ppm /Deg C
Input Impedance	>100M ohm

Address	Read	Write
Base +0	A/D low byte	Start 8 Bit Conversion
Base +1	A/D high byte	Start 12 Bit Conversion
Base +2	Current Channel Selected	Set Channel Select Mux
Base +3	Gain & Range Setting	Set Gain & Range

Base Address

Address 300H shown

The I/O base address is set with a bank of switches contained in a single DIP switch. The switch selects the first address for the first registers on the board (A/D Low Byte/ Start Conversion).
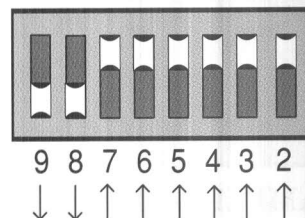
SW	HEX
A9	200
A8	100
A7	80
A6	40
A5	20
A4	10
A3	8
A2	4

Programming

The CIO-DAS48-PGA may be programmed directly with I/O write and read command providing control from BASIC, C and Pascal. It is quite easy to control the CIO-DAS48-PGA from any language that provides I/O instructions because of the simple register structure.

For those who prefer a language driver or library, the CIO-DAS48 is supported by the Universal Driver programming language support package (please see the data sheet).

Following is an example of register programming a single 12 bit A/D from a Basic subroutine:

```
ACQUIRE:
    BA% = &H300              'Set Base to 300 Hex
    OUT (BA% +1), 0         'Initiate a 12 bit A/D
    LOOP WHILE INP(BA% + 2 > 127)   'Wait for End of Conversion
    LSB% = INP(BA% + 0)     'Read the LS Byte
    MSB% = INP(BA% + 1)     'Read the MS Byte
    AD% = MSB% * 16 + LSB% / 16   'Combine to 12 bit value
    RETURN
```

Ordering Guide

48 Channel A/D board, gain of 0.5,1,2,4,8	CIO-DAS48-PGA
50 Connector Screw Terminal Board	CIO-MINI50
50 Conductor Cable, 2 ft. length	C50FF-2
50 Conductor Cable, Custom Length	C50FF-##

MEGA-FIFO

128 Million Sample Buffer for DT-Connect Equipped Data Acquisition Boards

Load with 256K, 1MB, 4MB or 16MB SIMMS

DT-Connect In and Out
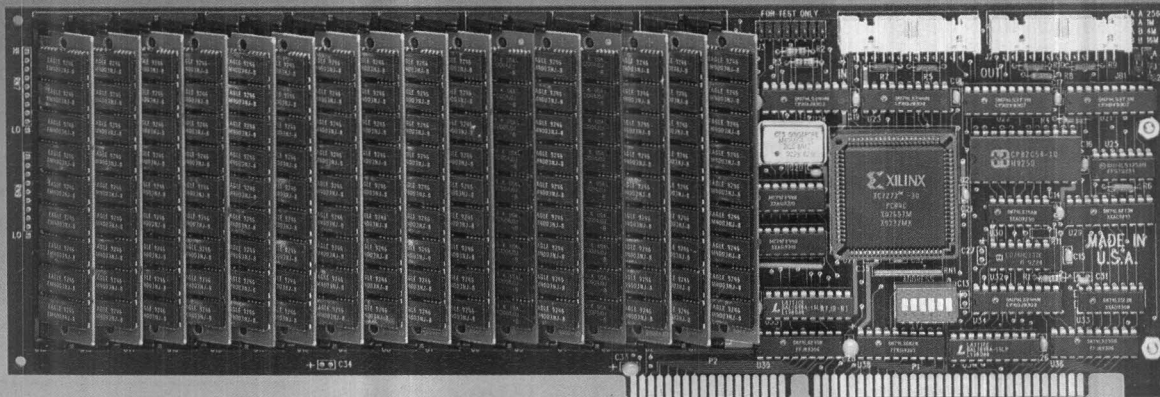
ISA Bus Does Not Slow Down
A/D and D/A Rates

MAGA SAMPLE DATA ACQUISITION BUFFER

The MEGA-FIFO allows you to acquire up to 128 million samples of A/D data without using any CPU or bus time. Because the MEGA-FIFO employs the DT-Connect board-to-board link, the PC bus is bypassed entirely. Supporting both DT-Connect in and out, the MEGA-FIFO may be used to hold sampled data or to update an output board.

Windows and high performance accessories pose significant resource challenges to fast A/D applications. Taken one at a time, disk controllers, LAN interfaces, mega-pixel display boards and fast A/D boards operate well within bus specifications, but, when combined into a system will exceed bus bandwidth. To acquire large sample

sets at high speed the data acquisition system must bypass the PC bus. The MEGA-FIFO memory uses Single Inline Memory Modules just like those on your CPU board. They are available from many sources and the price of SIMMs continues to decline. The MEGA-FIFO will accept 256K, 1MB, 4MB and the newest 16MB SIMMs.

The MEGA-FIFO may transfer through either the DT-Connect or the PC bus. The DT-Connect maximum rate is 1million samples per second. The PC bus maximum rate is 900K samples per second. Data may be transfered into or out of the MEGA-FIFO via the DT-Connect or the PC bus but not both at the same time. It is not possible to take data from the MEGA-FIFO via the PC bus while A/D data is loading the MEGA-FIFO via the DT-Connect.

BLOCK DIAGRAM

Memory modules must be all of one size and 80nS or faster.

Single Inline Memory Modules (SIMMs) must be installed two at a time in adjacent sockets to maintain word width.

MEGA-FIFO size may be:
256K SIMMS
256K to 2 Mega Samples
1MB SIMMS
1Mega to 8 Mega Samples
4MB SIMMS
4 Mega to 32 Mega Samples
16MB SIMMS
16 Mega to 128 Mega Samples

Memory Banks – SIMMs
SIMMs MUST BE INSTALLED IN PAIRS

SIMMs
SIZE
SELECT
LOGIC

15, 13, 11, 9,8 7,6 5,4 3,2 1,0
14 12 10

DTC IN

DTC OUT

Transfer Manager

Buffer Memory
Address Pointer

Total Count and
Transfer Pointer

Base Address

PC Bus Interface

Call for Friendly Technical Assistance - (508) 261-1123
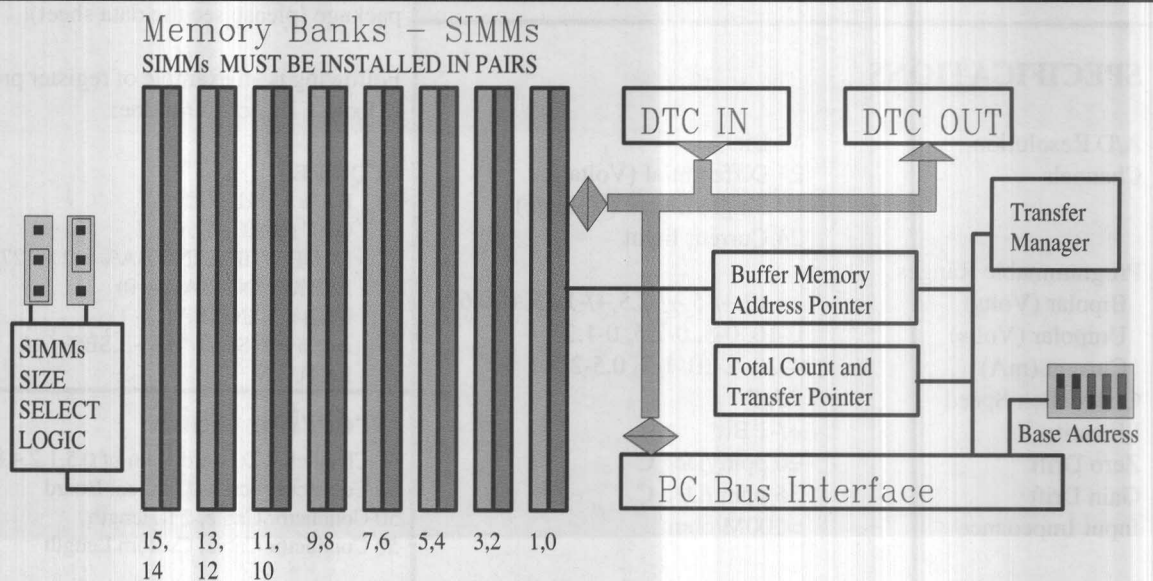
MEGA-FIFO WORKS WITH

The MEGA-FIFO supports all ComputerBoards' data acquisition boards wich have a DT-Connect interface. The list includes:

    CIO-DAS16/M1
    CIO-DAS16/330i & CIO-DAS16/330
    CIO-DAS1600/12 &   CIO-DAS1600/16

a few of which are shown here.
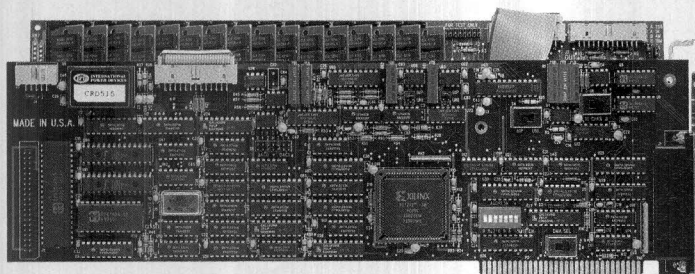
CIO-DAS1600/12 and CIO-DAS1600/16
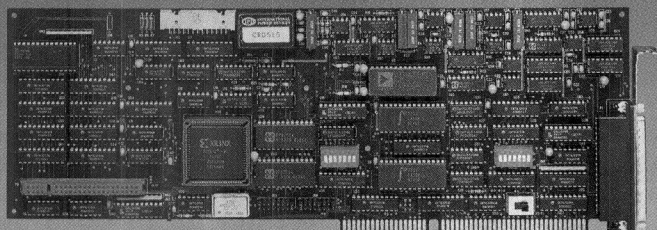
CIO-DAS16/M1
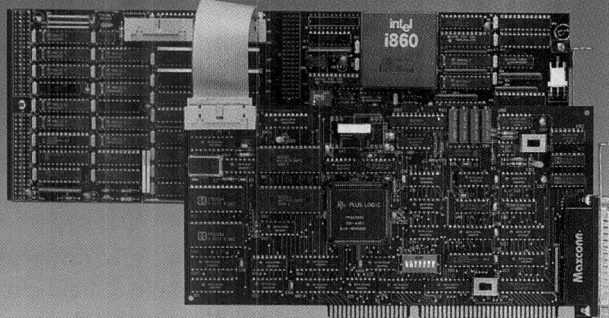
CIO-DAS16/330 & CIO-DAS16/330i

SPECIFICATIONS

Configuration	1-8 Banks of user supplied and installed SIMM memory. 2 Modules per bank
SIMM Size	256K, 1MB, 4MB or 16MB
Memory Addressing	Sequential, auto increment Reset to address zero
Access Time	80nS or faster
Memory Refresh	Synchronized to system refresh
Maximum Sample Size	2MS, 8MS, 32MS or 128MS
DT-Connect Max Rate	1 Million Samples per second, max
PC Bus Transfer Rate	900K Samples / Second typ

PROGRAMING

There is very little programming required to use a MEGA-FIFO in place of A/D transfers to PC memory. First, the data acquisition board must be set to transfer samples to the DT-Connect; a simple matter with ComputerBoards A/D boards.

From high level languages you have two choices. Employ the MEGA-FIFO support included in the Universal Driver (please see the data sheet on the Universal Driver). Alternately you may program the MEGA-FIFO directly using the I/O registers.

The MEGA-FIFO uses 16 I/O addresses:

Address	Read
Base +0	PC Data Word -
Base +2	Control Register - PC/DT Bus Enable, Direction, Int Enable
Base +4	Status Register - SIMM Jumper & IRQ Data
Base +6	Reserved
Base +8	8254 Counter 0 - Not used
Base +A	8254 Counter 1 - LSB - Rolover Bit Generates IR
Base +C	8254 Counter 2 - MSB - Memory Count Enable
Base +E	8254 Control

BASE ADDRESS

The I/O base address is set with a bank of switches contained in a single DIP switch. The switch selects the first address for the first register on the board.
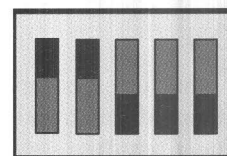
Each register is two bytes in length because the board uses the 16 bit PC-AT type bus.

Address 300H shown

SW	HEX
A9	200
A8	100
A7	80
A6	40
A5	20

9 8 7 6 5

TYPICAL APPLICATION

A Typical application would have a data acquisition board pass A/D data to the MEGA-FIFO over the DT-Connect. When the acquisition is complete, the data can then be retrieved from the MEGA-FIFO over the system PC bus and written to system memory for analysis, or to disk for storage.

The following code from the Universal Library shows the application of a MEGA-FIFO and CIO-DAS16/330.

```
AD% = 0, Mem% = 1               'ID for DAS16/330 and MEGA-FIFO
Options% = DTCONNECT
UDStat% = cbMemReset%(Mem%)
UDStat% = cbMemDTMode%(mem%, DTIN)
UDStat% = cbAInScan%(AD%, lo%, hi%, count&, rate&, range%, adc%(0),
Options%)
UDStat% = cbMemReset%(Mem%)
UDStat% = cbMemRead%(Mem%, membuffer%(0), Count&)
```

Ordering Guide

128 Million Sample Buffer for DT-Connect   MEGA-FIFO
 Equipped Data Acquisition Boards

6" DT-Connect Cable Included

CIO-SSH16

16 Channel Simultaneous Sample & Hold Accessory Board

16 DIFFERENTIAL INPUTS

INDIVIDUAL SWITCH SELECTABLE
GAINS OF:
1
10
100
200
300
500
600
700 &
800

16 SAMPLE & HOLD AMPLIFIERS.
LESS THAN 50 NANOSECONDS
APERTURE UNCERTAINTY

EACH CHANNEL IS
INDIVIDUALLY CALIBRATED

CALIBRATION SOFTWARE
INCLUDED
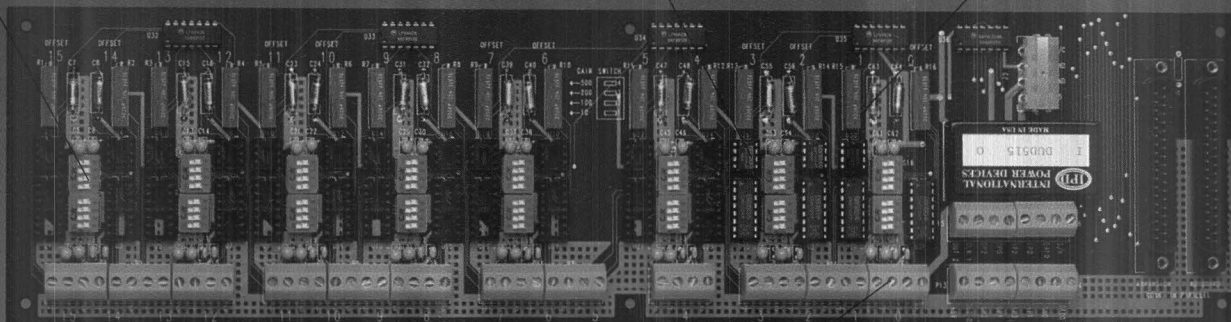
FULLY SUPPORTED BY ComputerBoards AND THIRD PARTY SOFTWARE
DUE TO AUTOMATIC, HARDWARE TRIGGERING.

SCREW TERMINALS
FOR 12-22 AWG

37 PIN D TYPE CONNECTOR
MATES WITH ALL CIO-AD
ANALOG INPUT BOARDS

DESCRIPTION

The CIO-SSH16 simultaneous sample and hold accessory acts as a front end signal amplification and capture for the CIO-DAS16 series of analog input boards.

There are two major functions on the board. Sixteen differential amplifiers have individual switch selectable gains of 1, 10, 100, 200 , 300, 500, 600, 700 and 800 providing very flexible amplification of individual signals. After amplification, each channel has a sample and hold which is controlled by the CIO-DAS analog input board. The total aperture uncertainty for all 16 circuits is less than 50 nanoseconds.

The CIO-SSH16 eliminates the channel to channel skew associated with multiplexed A/D inputs. A fast A/D board sampling at 100,000 samples per second will exhibit a minimum channel to channel skew of 10 microseconds. Since the skew is additive from channel to channel, the 16 channel total scan skew is 160 micro seconds. In applications where a number of signals must be analyzed and compared, such as high speed transient analysis and spectrum analysis, a channel to channel skew may be unacceptable.

Even low speed applications, such as oscillographic recording and display may require simultaneous sampling of all channels.

BLOCK DIAGRAM
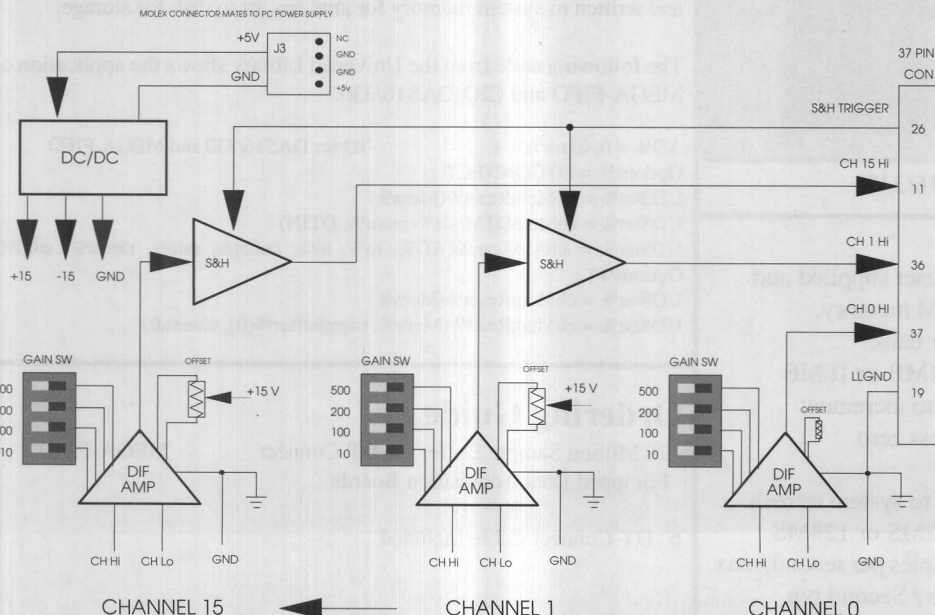
There are 16 separate fully differential amplification and sample & hold circuit blocks on the SSH16. One block, channel 0, uses the sample & hold chip on the CIO-DAS16. The S&H Trigger line enters TRACK whenever the CIO-DAS16 enters TRACK on channel 0. When the CIO-DAS16 enters HOLD for channel 0 the entire SSH16 enters HOLD also. The SSH16 remains in HOLD mode while the CIO-DAS16 samples channels 1, 2, 3 ...N. All SSH16 acquisition runs begin with channel 0 and by taking advantage of the CIO-DAS16 S&H chip, the A/D conversion and transfer rate equals the maximum throughput of the CIO-DAS.

Call for Friendly Technical Assistance - (508) 261-1123

S&HOUT (pin 26), synchronizes the LF398 sample & hold chips to the CIO-DAS16. The control signal is hardware generated so any CIO-DAS16 software works with the CIO-SSH16.

Power Consumption (Max.)   5.9 Watts

EACH CHANNEL HAS A GAIN AMPLIFIER

INPUT GAIN SWITCH

The input gain switch controls the amplification level of the INA110 differential input amplifier. Each switch controls one gain weight and weights are additive. Shown to the right is a gain of 500 + 100 = 600.

When all switches are to the right (off) the amp is at unity gain.

In addition, the CIO-DAS16 gains are multiplicative with the CIO-SSH16.

GAIN SWITCH

500	◼☐ 4
200	◼☐ 3
100	☐◼ 2
10	☐◼ 1

ON
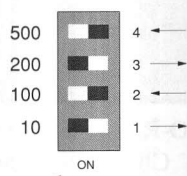
SUPERIOR TO PROGRAMMABLE GAIN

Programmable gain allows you to select a unique gain/range for every channel and to control the gain under software. A complete amplifier on every channel provides the same flexibility and superior performance. Here is why.

CALIBRATION: The A/D board should be calibrated for the one range it will be operated in. Each channel of the CIO-SSH16 can be calibrated for the range you want to gather data in. An A/D board with programmable gain can be calibrated for only one range at a time.

SPEED: Amplifying the input to the A/D should not limit the maximum A/D sample rate. The CIO-SSH16 will sample at the maximum A/D throughput even at maximum gain of 800. Checking the specifications of some programmable gain A/D boards show that the throughput limitations at high gains are sometimes severe.

FLEXIBILITY: Each channel should support a different gain even at DMA speeds. The CIO-SSH16 supports a different gain on every channel regardless of data transfer method. Many PGA A/D boards must remain in a single range during DMA operations. Those that are that flexible are also expensive and do not include simultaneous sample & hold.

SAMPLE & HOLD vs. BURST

Burst mode is often referred to a low cost simultaneous sampling method. Bursting is a way to minimize channel to channel skew but it does not eliminate it.

Burst mode uses a second counter to trigger scans of samples at the board's maximum rate. So if the board's maximum rate is 100KHz, the channel-to-channel-skew (time between each sample) will be 10uS +/-25nS. In a scan of 5 channels, that is a total skew of 50uS!

If you are doing FFT analysis of two 5KHz signals sampled at only 10 samples per cycle, a total skew of 50uS means an error of 10%! (20uS/200uS). Add channels and the error goes up by 5%/channel.

Compare that to an error of zero for a CIO-SSH16 sample set.

SOFTWARE

The CIO-DAS16 and CIO-SSH16 combination are supported by:

VIS-SIM Dacq	Paragon Control
Universal Driver	Snap-Master, Snap Shot
Control CB	CTOOLS
LabTech Notebook	TTOOLS
LabTech Control	Lab-Windows

ORDERING GUIDE

CIO-SSH16 Main board with 4 channels installed.   CIO-SSH16
One additional channel of amp and S&H.   CIO-SSH-AMP
12 may be added for a total of 16 channels on board.

NOTE: Additional channels of amplification and sample & hold may be ordered with the CIO-SSH16 and installed by the factory, or, ordered later and installed by you.

Cable, shielded round cable with molded connectors, 5 ft.   C37FFS-5
Cable, shielded round cable with molded connectors, 10 ft.   C37FFS-10

This shielded cable will provide a noise free signal path from your CIO-SSH16 to your CIO-DAS16.

ISO-RACK16 & ISO-RACK08

16 or 8 Channel Isolation Module Mounting & Interface Rack

ISO-RACK16 INTERFACES DIRECTLY TO DAS16. ISO-RACK08 DIRECT TO DAS08 BOARDS, OR TO DAS16 BOARDS USING THE CMUXAD16-10 CABLE

SCREW TERMINALS FOR TRIGGER, COUNTER AND DIGITAL SIGNALS

ISOLATION MODULES

AVAILABLE FOR:
VOLTS IN
CURRENT IN
THERMOCOUPLE IN
LINEARIZED TC
RTD (LINEARIZED)

ALL MODULES PROVIDE 1500 VRMS ISOLATION, CHANNEL TO CHANNEL.

+5V POWER DIRECT FROM PC VIA CMOLEX-10 POWER CABLE (included)

SCREW TERMINALS FOR ROUTING SIGNALS THROUGH THE ISOLATION MODULES

ISO-RACK08 SHOWN HERE

DESCRIPTION

The ISO-RACK16 & ISO-RACK08 are mounting and interface racks for use with Analog Devices or Burr-Brown 5B type analog isolation modules. These modules provide signal conditioning and hundreds of volts of isolation from harsh electrical environments. The ISO-RACK is the perfect means of interfacing 5B modules to any data acquisition board.

Providing positions for 16 or 8 modules, the ISO-RACK has screw terminals for each module. The Screw terminals allow you to connect signals via 12-22 AWG wire. The signals are routed through the isolation modules to the 37 pin D connector. Your data acquisition board plugs into the ISO-RACK via a standard 37 conductor cable, such as the C37FF-2.

The ISO-RACK16 is 100% connector compatible with Computer Boards' CIO-DAS16 family of boards and the ISO-RACK08 is 100% connector compatible with Computer Boards' CIO-DAS08 family of boards

Using the special cable, C-MUXAD16-10, the ISO-RACK08 may be used with the CIO-DAS1600, CIO-DAS16Jr, CIO-DAS/330i and MetraByte's DAS-16. Pictured below right is a CIO-DAS16Jr. and ISO-RACK08

Modules are available for Voltage Input, Current Input, RTD Input and both Linearized and Non-Linearized Thermocouple Inputs. All modules provide 1500 Vrms transformer based isolation and are potted for rugged, industrial use.

FULLY ISOLATED SYSTEM

CIO-DAS08   ISO-RACK08

C37FF-2 CABLE

SSR-RACK24 - DIGITAL SOLID STATE RELAYS
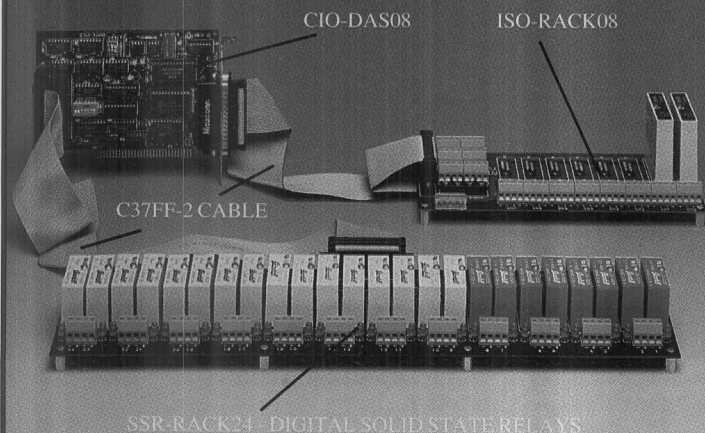
LOW COST HIGH SPEED ISOLATED SYSTEM
8 CHANNELS SHOWN, 16 AVAILABLE

CMUXAD16-10 CABLE MUST BE USED WITH ISO-RACK08

CIO-DAS16Jr   ISO-RACK08

Call for Friendly Technical Assistance - (508) 261-1123
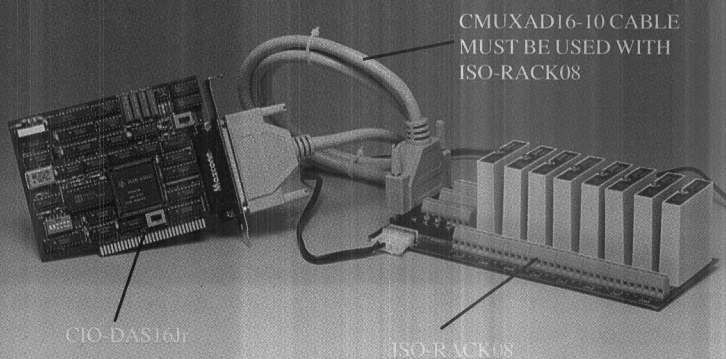
ISOLATION MODULES

VOLTAGE	INPUT	OUTPUT
ISO-5B30-01	+/-10mV	+/-5V
ISO-5B30-02	+/-50mV	+/-5V
IOS-5B30-03	+/-100mV	+/-5V
ISO-5B30-04	+/-10mV	0-5V
ISO-5B30-05	+/-50mV	0-5V
ISO-5B30-06	+/-100mV	0-5V
ISO-5B31-01	+/-1V	+/-5V
ISO-5B31-02	+/-5V	+/-5V
ISO-5B31-03	+/-10V	+/-5V
ISO-5B31-04	+/-1V	0-5V
ISO-5B31-05	+/-5V	0-5V
ISO-5B31-06	+/-10V	0-5V

VOLTAGE 10KHz	INPUT	OUTPUT
ISO-5B40-01	+/-10mV	+/-5V
ISO-5B40-02	+/-50mV	+/-5V
IOS-5B40-03	+/-100mV	+/-5V
ISO-5B40-04	+/-10mV	0-5V
ISO-5B40-05	+/-50mV	0-5V
ISO-5B40-06	+/-100mV	0-5V
ISO-5B41-01	+/-1V	+/-5V
ISO-5B41-02	+/-5V	+/-5V
ISO-5B41-03	+/-10V	+/-5V
ISO-5B41-04	+/-1V	0-5V
ISO-5B41-05	+/-5V	0-5V
ISO-5B41-06	+/-10V	0-5V

CURRENT Input		
ISO-5B32-01	4-20mA	0-5V
ISO-5B32-02	0-20mA	0-5V

Thermocouple	INPUT	OUTPUT
ISO-5B37-J	-100C to +760C	0-5V
ISO-5B37-K	-100C to +1350C	0-5V
ISO-5B37-B	0C to +1800C	0-5V
ISO-5B37-R	0C to +1750C	0-5V
ISO-5B37-T	-100C to +400C	0-5V
ISO-5B37-E	0C to +900C	0-5V
ISO-5B37-S	0C to +1750C	0-5V

Thermocouple - Linearized			Accuracy
ISO-5B47-J-01	0C to +760C	0-5V	+/-1.1C
ISO-5B47-J-02	-100C tp +300C	0-5V	+/-0.5C
ISO-5B47-J-03	0C to +500C	0-5V	+/-0.6C
ISO-5B47-K-04	0C to +1000C	0-5V	+/-1.3C
ISO-5B47-K-05	0C to +500C	0-5V	+/-0.6C
ISO-5B47-T-06	-100C to +400C	0-5V	+/-1.4C
ISO-5B47-T-07	0C to +200C	0-5V	+/-0.5C
ISO-5B47-E-08	0C to +1000C	0-5V	+/-1.7C
ISO-5B47-R-09	+500C to +1750C	0-5V	+/-2.5C
ISO-5B47-S-10	+500C to +1750C	0-5V	+/-2.4C
ISO-5B47-B-11	+500C to +1800C	0-5V	+/-5.1C

RTD Inputs - Linearized			Type
ISO-5B34-01	-100C to +100C	0-5V	Platinum 100 Ohm
ISO-5B34-02	0C to +100C	0-5V	Platinum 100 Ohm
ISO-5B34-03	0C to +200C	0-5V	Platinum 100 Ohm
ISO-5B34-04	0C to +600C	0-5V	Platinum 100 Ohm
ISO-5B34-C-01	0C to +120C	0-5V	Copper 10 Ohm
ISO-5B34-C-02	0C to +120C	0-5V	Copper 25 Ohm
ISO-5B34-N-01	0C to +300C	0-5V	Nickel 120 Ohm

STRAIN GAGE Input	Excitation	Output	Type
ISO-5B38-02	300 to 10K Ohm	10.0V @ 3mV/V	+/-5V	Full Bridge
ISO-5B-38-05	300 to 10K Ohm	10.0V @ 2mV/V	+/-5V	Full Bridge
ISO-5B-38-04	300 to 10K Ohm	10.0V @ 3mV/V	+/-5V	Half Bridge

Specification	5B30	5B31	5B40	5B41	5B37	5B47	5B32	5B34
Type	Voltage	Voltage	Voltage 10Khz	Voltage 10KHz	TC	Linear TC	Current	RTD
Accuracy - +/-0.05% Span &	+/-10uV	+/-0.2mV	+/-10uV	+/-0.2mV	+/-10uV	See Above	+/-0.05%(Iz)	+/-0.1 Ohm
Nonlinearity	+/-0.02% Span	Same	Same	Same	Same		Same	
Stability vs Ambient Temp								
Input Offset	+/-1uV/dC	+/-20uV/dC	+/-1uV/dC	+/-20uV/dC	+/-0.02dC/dC	+/-1uV/dC	+/-0.0025%/dC	+/-0.02dC/dC
Output Offset	+/-20uV/dC	+/-20uV/dC	+/-20uV/dC	+/-20uV/dC	+/-20uV/dC	N/A	N/A	+/-20uV/dC
Gain	+/-25ppm/dC	+/-50ppm/dC	+/-25ppm/dC	+/-25ppm/dC	+/-25ppm/dC	+/-25ppm/dC	+/-0.0025%/dC	+/-50ppm/dC
Input Bias Current	+/-3nA	+/-0.2nA	+/-3nA	+/-0.2nA	-25nA	-25nA		+/-3nA
Input Resistance - Normal	5M Ohm	650K Ohm	200M Ohm	650K Ohm	5M Ohm	5M Ohm		5M Ohm
Power Off	40K Ohm	650K Ohm	40K Ohm	650K Ohm	40K Ohm	40K Ohm		40K Ohm
Overload	40k Ohm	650K Ohm	40K Ohm	650K Ohm	40K Ohm	40K Ohm		40K Ohm
Noise - Input 0.1-10 Hz	0.2uVrms RTI	2uVrms RTI	0.4uVrms RTI	2uVrms RTI	0.2uVrms RTI	N/A	10nVrms RTI	0.2uVrms RTI
Output 100 Hz	10uVrms RTO	10uVrms RTO	10mV PTP	10mV PTP	10uVrms RTO	500uVrms RTO	10uVrms RTO	10uVrms RTO
Output Resistance	50 Ohm	50 Ohm	50 Ohm	50 Ohm	50 Ohm	50 Ohm	50 Ohm	
Bandwidth, -3dB	4Hz	4Hz	10KHz	10KHz	-3dB	-3dB	4Hz	4Hz
Response to 90% Span	0.2S	0.2S	35uS	35uS	0.2S	0.2S	0.2S	0.2S
Voltage Output Protection	Cont. Short	Cont. Short	Cont. Short	Cont. Short	Cont. Short	Cont. Short	Cont. Short	
Input Protection Cont.	240V rms	240V rms	240V rms	240V rms	240V rms	240V rms		
CMV Input to Output	1500Vrms	1500Vrms	1500Vrms	1500Vrms	1500Vrms	1500Vrms	1500Vrms	1500Vrms
CMR at 50 or 60 Hz	160dB	160dB	100dB	90dB	160dB	160dB	160dB	160dB
NMR at 50 or 60 Hz	90dB	90dB	90dB	90dB	90dB	60dB	90dB	90dB
CJC - Initial Accuracy					+/-0.25 Deg C	+/-0.25 Deg C		
Over +5 Deg C to +45 dC					+/-0.5 Dec C	+/-0.5 Deg C		
Open Input Detect Time					10S	10S		
Input Resistor - Value							20.00 Ohm	
Accuracy							+/- 0.01%	
Stability							+/-0.001%/dC	
Sensor Excitation Current 100 Ohm Pt., 120 Ohm Ni								0.25mA
10 Ohm Cu.								1.0mA

Power Consumption	150mW(30MA), All Models	Environmental - Op. Temp	-25 Deg C to 85 Deg C, All models
Power Supply Voltage	+5V +/-5%, All Models	Storage Temperature	-40 Deg C to 85 Deg C, All Models
Relative Humidity	0 - 95% Non Condensing, All Models	RFI Susceptibility	+/-0.5% of Full Scale at 400 MHz at 5W from 3', All

CIO-EXP32 & CIO-EXP16

32 Channel Analog Input Multiplexor & Thermocouple Signal Conditioning Accessory Board

- 32 DIFFERENTIAL INPUTS
- 2 SWITCH SELECTABLE GAINS OF:
  1
  10
  100
  200
  300
  500
  600
  700 &
  800
- OPTIONAL 7Hz INPUT FILTER CAPACITORS
- OPTIONAL 5 V POWER MOLEX CONNECTOR
- JUMPER BLOCKS MAP MUX INPUTS AND CJC INTO 1 OF 8 OR 16 A/D
- JUMPER FOR USE WITH CIO-DAS08 OR CIO-DAS16

- FULLY SUPPORTED BY LANGUAGE DRIVERS AND THIRD PARTY SOFTWARE
- COLD JUNCTION TEMPERATURE SENSOR
- SCREW TERMINALS FOR 12-22 AWG
- THERMOCOUPLE OPEN DETECT
- OPTIONAL DC/DC CONVERTER +/-15V CIO-PG408

DESCRIPTION

The CIO-EXP32 analog input multiplexor expands the total of analog input channels of any A/D board by 32 channels. Two banks of 16 analog inputs, are multiplexed into two of the A/D board's analog input channels.

In addition to expanding inputs by a factor of 16, the CIO-EXP32 analog inputs are fully differential and have a switch selectable gain amplifier and additional circuitry for thermocouples.

The 16 channel multiplexors are controlled by 4 digital lines from the CIO-DAS08, CIO-DAS16 or other A/D board.

Thermocouple measurements are easy with the CIO-EXP32. Each input channel has circuitry for open Thermocouple detect, 7Hz input filtering and 10K ground reference. The passive components which provide these features may optionally be included in each channel's inputs by closing a small solder bridge pad. Thermocouple inputs are accurate to +/- 2 deg. C.

The CIO-EXP32 is supported by software, such as Labtech Notebook and Control CB, and language drivers CTOOLS, TTOOLS and Universal Driver.

EXP BOARD BLOCK DIAGRAM - ONE BANK OF 16 INPUTS
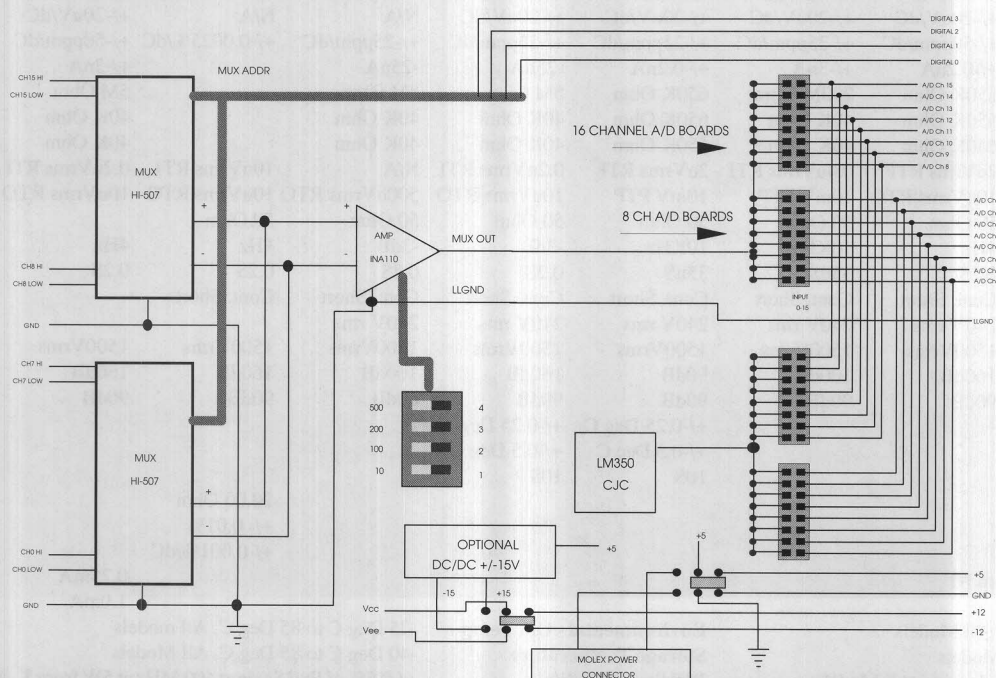
CIO-MUX INPUT - ONE CHANNEL

C = FILTER CAPACITOR. PAD CLOSED
V = OPEN TC DETECT. PAD OPEN
G = REF TO GROUND. PAD OPEN
PADS ARE LOCATED ON CIRCUIT SIDE
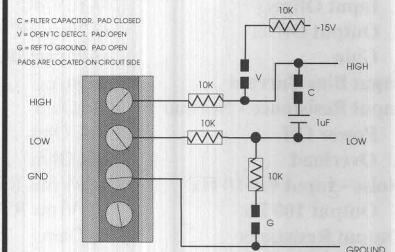
CIO-MUX SIGNAL CONNECTOR

NC/ LLGND	19	37	OUTPUT 0
LLGND/ OUTPUT 8	18	36	OUTPUT 1
OUTPUT 9	17	35	OUTPUT 2
OUTPUT 10	16	34	OUTPUT 3
OUTPUT 11	15	33	OUTPUT 4
OUTPUT 12	14	32	OUTPUT 5
OUTPUT 13	13	31	OUTPUT 6
OUTPUT 14	12	30	OUTPUT 7
OUTPUT 15	11	29	+5 VOLTS
MUX ADDR 4	10	28	POWER GND
MUX ADDR 3	9	27	NC
MUX ADDR 2	8	26	NC
MUX ADDR 1	7	25	NC
NC	6	24	NC
NC	5	23	NC
NC	4	22	NC
NC	3	21	NC
NC	2	20	-12V PC BUS
+12 PC BUS	1		
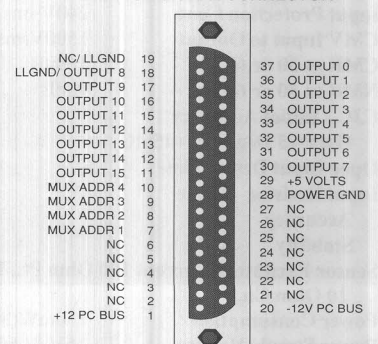
USED WITH THE CIO-DAS08

The CIO-EXP32 and CIO-EXP16 are designed to be used as an analog input expansion, amplification and thermocouple input accessory for the CIO-DAS08. Each of the 8 CIO-DAS08 analog inputs map into 16 of the CIO-EXP inputs. Either 4 EXP32 or 8 EXP16 boards may be connected to a CIO-DAS08 expanding the total number of analog inputs to 128. Four of the CIO-DAS08 digital outputs control the EXP32 and EXP16 multiplexors

USED WITH THE CIO-DAS16

The CIO-EXP32 and CIO-EXP16 may also be used as an analog input expansion amplification and Thermocouple input accessory for the CIO-DAS16. Each of the 16 CIO-DAS16 analog inputs map into 16 of the CIO-EXP inputs. Either 8 EXP32 or 16 EXP16 boards may be connected to a CIO-DAS16 expanding the total number of analog inputs to 256. Four of the CIO-DAS16 digital outputs control the EXP32 and EXP16 multiplexors. A cable, C-MUXAD16-10, must be used to connect the CIO-DAS16 to the first CIO-EXP, and a DC/DC converter, part no. CIO-PG408 must be installed in each CIO-EXP board.

CASCADING EXP32 & EXP16

CABLES TO CASCADE MUX32 & MUX16s
MAY BE C37FF-2 OR C37FFS-5

PC WITH A/D BOARD

MUX#3   MUX#2   MUX#1

128 CHANNELS TOTAL WITH CIO-AD08
256 CHANNELS WITH CIO-AD16

FIRST CABLE IN SERIES
IF A/D BOARD IS AD16
MUST BE C-MUXAD16-10
FOR AD08 ANY 1:1 37 PIN
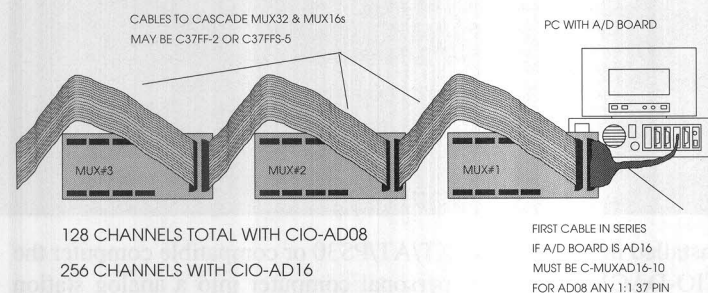
CIO-EXP32s and EXP16s may be cascaded to expand the total of analog inputs of any A/D board. Each bank of 16 EXP board analog inputs use one of the A/D board's analog inputs. The EXP32 has two banks of 16 inputs, the EXP16 only one. Cascading EXP boards will raise the number of CIO-DAS08 analog inputs from 8 single ended to 128 fully differential!

Each EXP board has one Cold Junction Compensation (CJC) circuit and output. The CJC output uses one of the A/D board's analog inputs and is required when thermocouples are connected to a EXP board. Only one CJC is needed in a series, so a total of 112 thermocouples may be monitored by a CIO-DAS08 or 240 with a CIO-DAS16.

SPECIFICATIONS

CHANNELS	EXP32 = 32, EXP16 = 16
Differential Amplifier	INA110
Gain Weights	1,10,100,200,500
Input Protection	+/- 35 V Continuous
Common Mode Voltage	+/- 10V Max.
Common Mode Rejection	> 90dB All Ranges
Analog Output Voltage	+/- 10V Max.
Thermocouple Types	J,K,T,E,S,R,B
Cold Junction Compensation	+24.4 mV/Deg C (0V @ 0C)
Noise RMS 10KHz - 100KHz	10 uVolts
Accuracy - Voltage	0.01% of reading +/- 1 bit
Accuracy - Thermocouple	+/- 2 Deg C
Power Consumption EXP32	5V @ 26mA, +/-V @ 36mA
Power Consumption EXP16	5V @ 26mA, +/-V @ 25mA
Dimensions EXP32/ EXP16	16" X 4" / 9" X 4"

CIO-EXP16
16 Channel Analog Multiplexor
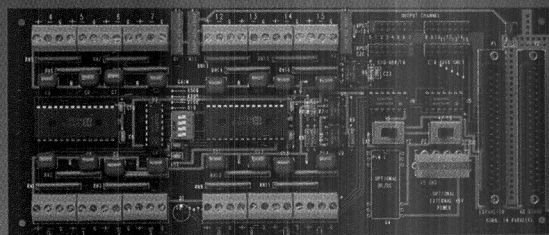
The CIO-EXP16 is one half of a CIO-EXP32 and shares all the features and specifications of the 32 channel board at a lower cost. For applications where cost is the issue and 16 channels or less of thermocouple or expanded analog input are needed.

16 CHANNEL GAIN AMPLIFIER SWITCH

The input gain switch controls the amplification level of the INA110 differential input amplifier. Each switch controls one gain weight and weights are additive. Shown to the right is a gain of 500 + 100 = 600.

When all switches are to the right (off) the amp is at unity gain.

GAIN SWITCH

500   4
200   3
100   2
10   1
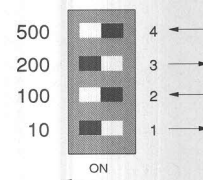
ON

RECOMMENDED THERMOCOUPLE /GAIN SETTINGS

TC TYPE	uV / Deg. C	OUTPUT V	@ Deg. C	USE GAIN
J	51 uV	43 mV	760	100
K	40 uV	55 mV	1370	100
T	40 uV	21 mV	400	100
E	62 uV	76 mV	1000	100
S	7 uV	19 mV	1760	200
R	7 uV	21 mV	1760	200

Data from OMEGA Temperature catalog.

ORDERING GUIDE

32 channel analog multiplexor with TC inputs.	CIO-EXP32
16 channel analog multiplexor with TC inputs.	CIO-EXP16
Cable, 37 conductor ribbon, 2 ft.	C37FF-2
Cable, 37 conductor ribbon, ## ft.	C37FF-##
Cable, shielded round cable with molded connectors, 5 ft.	C37FFS-5
Cable, shielded round cable with molded connectors, 10 ft.	C37FFS-10
Cable, shielded 10 ft. Must be used between the CIO-DAS16 and the first CIO-EXP used with a CIO-DAS16.	C-MUXAD16-10
DC/DC Converter. 5V in +/-15V out. Must be installed when the CIO-EXP is used with the CIO-DAS16	CIO-PG408

SOFTWARE

The CIO-DAS08 and CIO-EXP combination are supported by:

Universal Driver	CTOOLS
Control CB	Paragon Control
LabTech Notebook	TTOOLS
LabTech Control	

Any software which supports the MetraByte EXP-16 automatically supports the CIO-EXP32 and CIO-EXP16.

CIO-DAC16 & CIO-DAC08
16 Channel Analog Output Board and 8 Channel Analog Output Board
ONE INDEPENDENT DAC FOR EACH CHANNEL

SELECT OUTPUT RANGE FOR EACH CHANNEL
CIO-DAC16 & CIO-DAC08
+/-10V, +/-5V, +/-2.5V, 0-10V, 0-5V, 0-2.5V
CIO-DAC16i & CIO-DAC08i 4-20mA Only

ANALOG OUTPUT CONTROL REGISTERS ARE
SOFTWARE COMPATIBLE WITH CIO-DDA06

37 PIN CONNECTOR
ACCEPTS C37 CABLES
AND SCREW TERMINALS
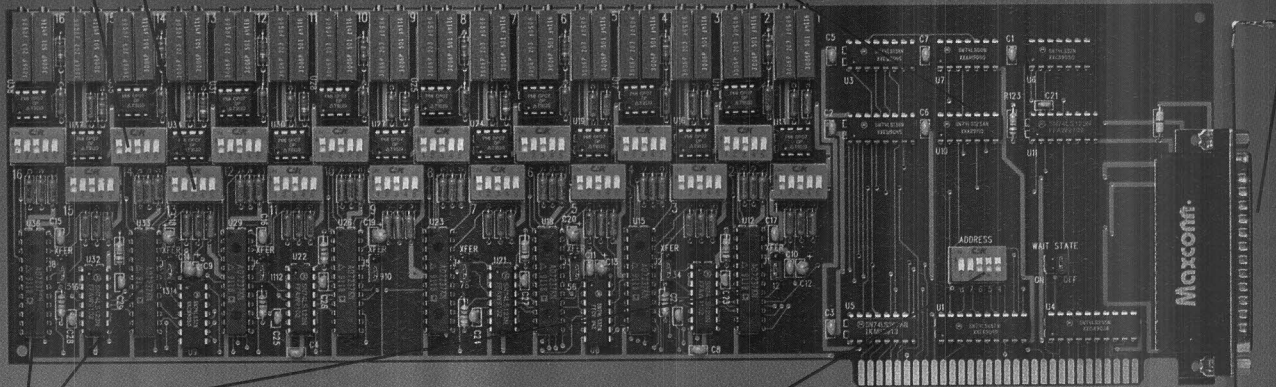
16 FULLY INDEPENDENT ANALOG OUTPUT CIRCUITS
(NOT A CHEAP SAMPLE & HOLD DESIGN)

BASE ADDRESS SWITCH

PLUG INTO ANY PC/XT/AT/386

DESCRIPTION

The CIO-DAC16 analog output board provides 16 independent, 12 bit digital to analog converters with a number of output range choices available. The CIO-DAC08 has the same ranges and connector pin-out with 8 channels and a lower price.

The CIO-DAC16i and CIO-DAC08i are for current output applications and are set to a 4-20mA range, providing a full 12 bits of resolution over that range.

Installed in any IBM PC/XT/AT/PS30 or compatible computer the CIO-DAC16 turns your personal computer into a analog station suitable for proportional valve control, 16 channel stimulus/response experimentation or simple voltage driven control.

The CIO-DAC16 is supplied with a complete user's manual and calibration software. It is supported by Control-CB and Labtech Notebook as well as the Universal Driver, CTOOLS and TTOOLS.

CIO-DAC16 BLOCK DIAGRAM
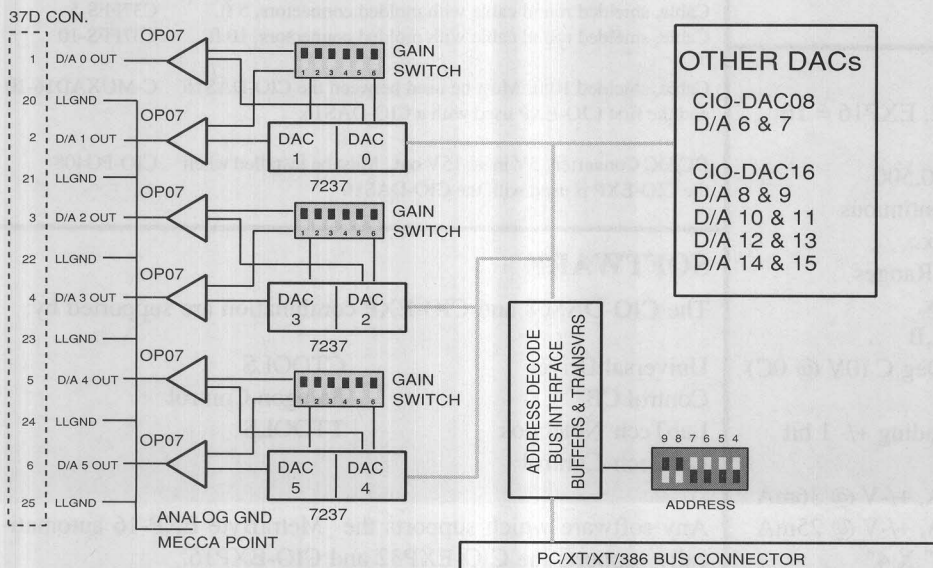
CIO-DAC16 CONNECTOR

NOTE: For CIO-DAC08, pins 9-16 are NC

-12V 19	37 GND
GND 18	36 +5V
+12V 17	35 LLGND
D/A 15 OUT 16	34 LLGND
D/A 14 OUT 15	33 LLGND
D/A 13 OUT 14	32 LLGND
D/A 12 OUT 13	31 LLGND
D/A 11 OUT 12	30 LLGND
D/A 10 OUT 11	29 LLGND
D/A 9 OUT 10	28 LLGND
D/A 8 OUT 9	27 LLGND
D/A 7 OUT 8	26 LLGND
D/A 6 OUT 7	25 LLGND
D/A 5 OUT 6	24 LLGND
D/A 4 OUT 5	23 LLGND
D/A 3 OUT 4	22 LLGND
D/A 2 OUT 3	21 LLGND
D/A 1 OUT 2	20 LLGND
D/A 0 OUT 1	

Call for Friendly Technical Support - (508) 261-1123

Groups of D/As, or the entire 16 channels may be set to update simultaneously. When set for simultaneous update, The D/A data written to the D/As has no effect on the output value until the board is commanded to update all simultaneous channels. At that instant, all channels are updated at once.

SOFTWARE SUPPORT

The CIO-DAC16 is supplied with software for calibration and test. In addition, Universal Driver, CTOOLS and TTOOLS provide for:

Single Channel Analog Out
Simultaneous Update of Multiple Analog Outputs

ACCESSORIES

A complete line of screw terminal boards and cables support both the analog output and digital I/O signals. Screw terminal boards accept 12-22 AWG wire and are constructed of high quality black FR4 with durable jaw-type screw terminals.

CIO-MINI37
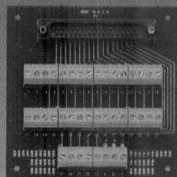
C37FFS-5 CABLE
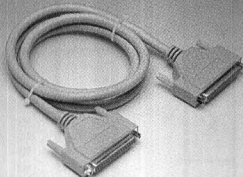
CIO-DAC08
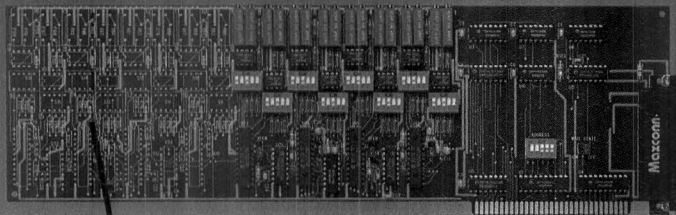
Unused 8 DAC positions cannot be populated.

BASE ADDRESS SWITCH

The CIO-DAC16 occupies 32 consecutive I/O addresses. The first, or Base Address, is set by a bank of switches in a DIP switch on the board. It is possible to set the base address of the CIO-DAC16 anywhere within the range 0 to 3FF Hex.

Address 300H shown
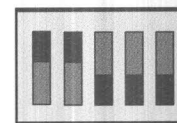
SW	HEX
A9	200
A8	100
A7	80
A6	40
A5	20

9 8 7 6 5

D/A SPECIFICATIONS   12 BIT

Channels	16 Voltage Output
Resolution	12 Bit, 1 part in 4095
D/A Type	Dual DAC, AD7237
Latches	Double buffered/Sim. Update
Linearity	+/- 1/2 Bit
Monotonicity	+/- 1/2 Bit
Temperature drift	1ppM Typ., 3ppM Max @ 0V
	15ppm Typ., 30ppM max @ FS
Load Current	+/-5mA Max
Short Circuit Current	40mA Max
Output Resistance	<0.1 ohm
Settling Time + FS 0.01%	3uS Typical, 5uS Max
Settling Time -FS 0.01%	5uS Typical, 10uS
Wait State - Jumper selected on/off	1uS when enabled.
OUTPUT RANGES	
CIO-DAC16 & CIO-DAC08	+/-10, +/-5, +/-2.5, 0-10, 0-5, 0-2.5
CIO-DAC16i & CIO-DAC08i	4-20mA Only

ORDERING GUIDE

16 Channel D/A - Voltage Ranges	CIO-DAC16
8 Channel D/A - Voltage Ranges	CIO-DAC08
16 Channel D/A 4-20mA	CIO-DAC16i
8 Channel D/A 4-20mA	CIO-DAC08i
Screw Terminal Boards	
16" X 4" all signals from one 37 D plus proto area & circuitry.	CIO-TERMINAL
4" X 4" all signals from one 37 D connector.	CIO-MINI37
16" X 4" all signals from one 37D, Spade Lug Terminals.	CIO-SPADE50
Cables	
2 foot ribbon cable, 37 conductor, female connectors.	C37FF-2
'N' foot ribbon cable, 37 conductor, female connectors.	C37FF-N
5 foot shielded cable, molded female connectors, 37 cond.	C37FFS-5
10 foot shielded cable, molded female connectors, 37 cond.	C37FFS-10

CIO-DDA06/16 & CIO-DDA06/12

6 Channel, 16 Bit or 12 Bit Resolution, Analog Output, 24 Digital I/O

ONE COMPLETE ANALOG OUTPUT
CIRCUIT PER CHANNEL

24 BIT DIGITAL I/O
CHIP 82C55

SWITCH
SELECT
GAINS OF:
+/-10V
+/-5V
+/-2.5V
+/-1.67V
AND
0-10V
0-5V
0-2.5V
0-1.67V

37 PIN CONNECTOR

37 PIN CONNECTOR
ACCEPTS C37 CABLES,
SCREW TERMINAL
BOARDS AND ACCES-
SORY BOARDS.

BASE ADDRESS SWITCH

PLUG INTO ANY PC/XT/AT
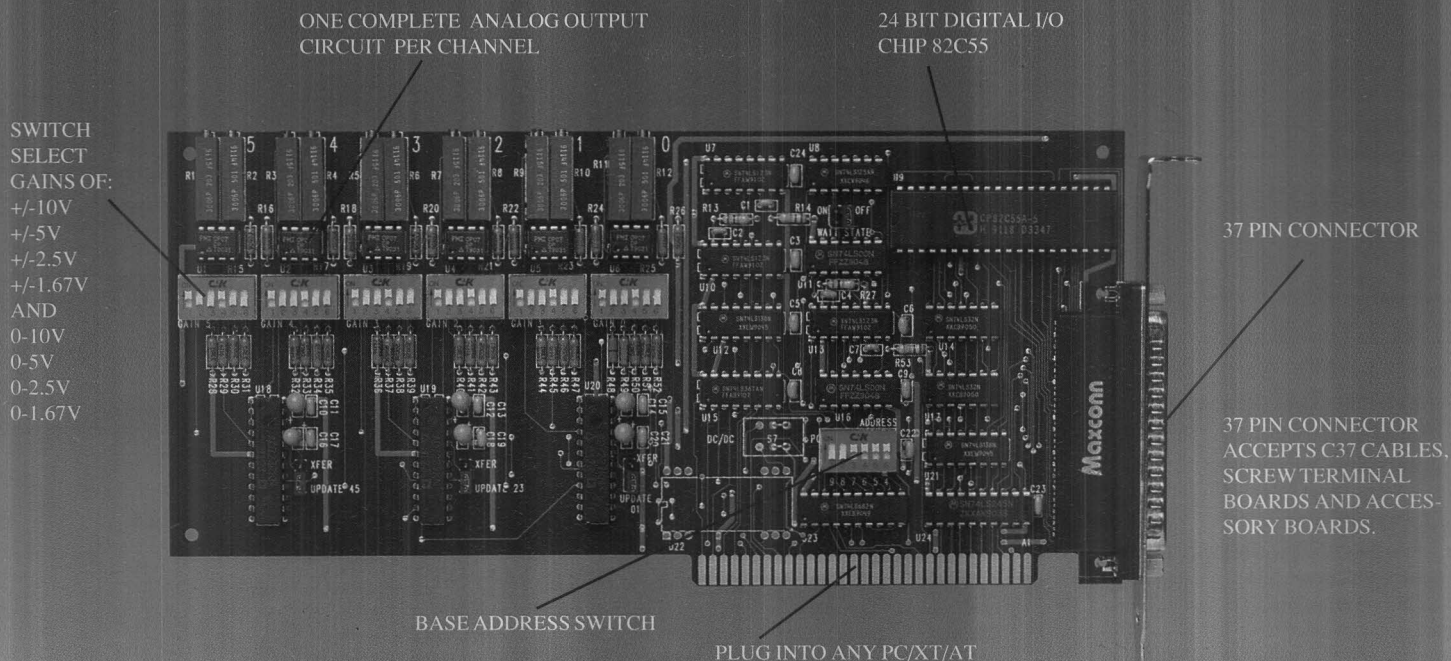
DESCRIPTION

The CIO-DDA06 analog output and digital I/O board is available with either 16 bit (1 part in 65,535) or 12 bit (1 part in 4,095) resolution.

Installed in any IBM PC/XT/AT/PS30 or compatible computer the CIO-DDA06 turns your personal computer into a analog and digital control station suitable for proportional valve control, high voltage AC and DC contact monitoring and on/off control. The CIO-DDA06 is two boards in one; a 24 bit digital input/output board that is CIO-DIO24 compatible and a 6 channel analog output board. The 37 pin D connector's 24 digital I/O pins are assigned identically to the CIO-DIO24. The analog outputs occupy the remaining pins. This means that accessories such as the SSR-RACK24 just plug right in!

The CIO-DDA06 is supplied with a complete user's manual, calibration software and is supported by language drivers Universal Driver, CTOOLS and TTOOLS as well as Control-CB and Labtech Notebook.

CIO-DDA06 BLOCK DIAGRAM
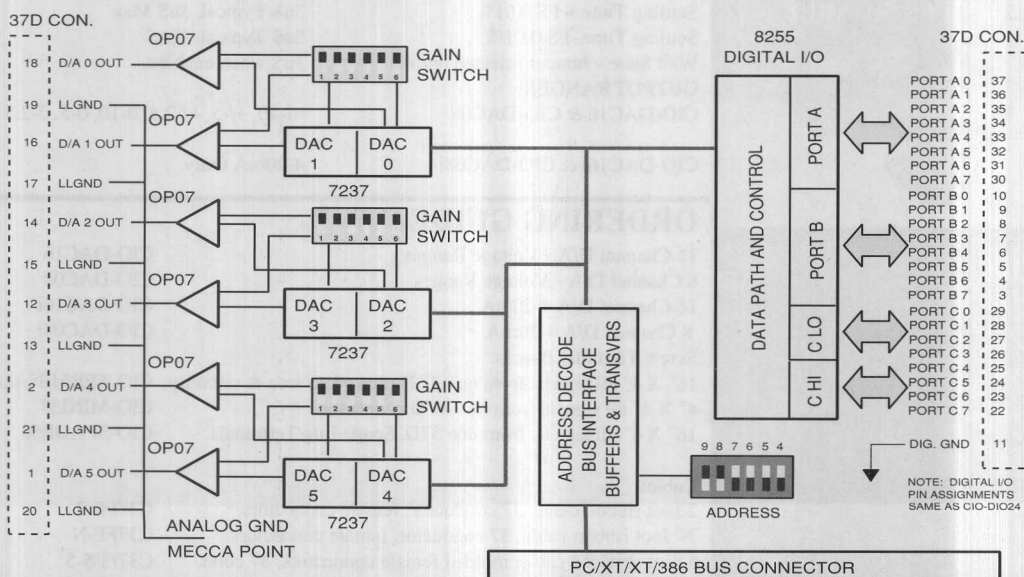
CIO-DDA06 CONNECTOR
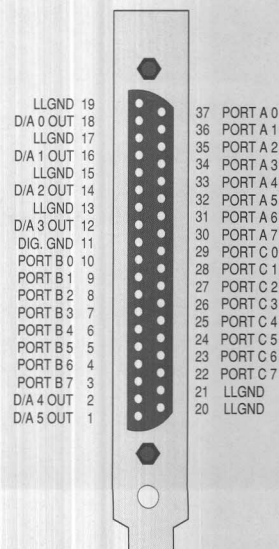
RANGE SELECTION

The analog output range is fully switch selectable. The CIO-DDA06/12, 12 bit range may vary from as much as bipolar +/-10V to as little as unipolar 0-1.67V. Resolution may vary from 4.88mV/bit to as little as 408uV/bit.

The CIO-DDA06/16, 16 bit range may vary from +/-10V (300uV/Bit) to +/-2.5 (67uV/Bit). The advantage of the 16 bit CIO-DDA06/16 is greater resolution over a wider dynamic range. In other words, in the +/-10V range you can make a measurement 16 more accurate with a 16 bit board.

The CIO-DDA06 provides different stages of gain/range to allow you to bracket more closely the signal you wish to simulate, or to match the range exactly to the proportional device you wish to control.

SOFTWARE SUPPORT

The CIO-DDA06 is supplied with software for calibration and test. In addition, the Universal Driver, CTOOLS and TTOOLS provide high level language support for :

     Single Channel Analog Out
     Simultaneous Update of Multiple Analog Outputs
     Digital Configuration & Control
     Digital Bit Read/Write
     Digital Port Byte Read/Write

Menu driven control programs such as Control-CB, Labtech Notebook and Labtech Control support the CIO-DDA06

SIGNAL CONDITIONING & ACCESSORIES

Solid State Relays provide over 4,000 Volts isolation and allow the CIO-DDA06 to sense or control high-voltage AC and DC voltages. The solid state relays mount on the SSR-RACK24 (pictured below) which interfaces directly to the CIO-DDA06.

A complete line of screw terminal boards and cables support both the analog output and digital I/O signals. Screw terminal boards accept 12-22 AWG wire and are constructed of high quality black FR4 with durable jaw-type screw terminals.

CIO-MINI37
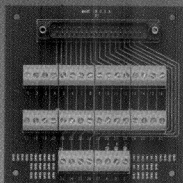
C37FFS-5 CABLE
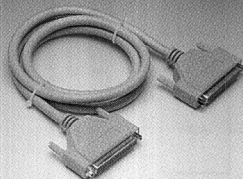
C37FF-2 CABLE
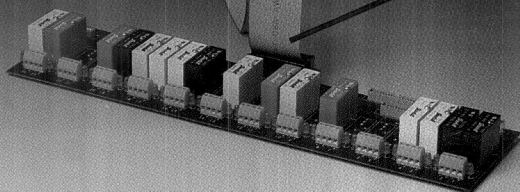
SSR-RACK24 with CIO-DDA06
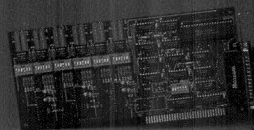
I/O & CONTROL REGISTER MAP

The CIO-DDA06/12 and CIO-DDA06/16 are 100% software compatible because the I/O registers have identical functions on each board. I/O registers are the locations which the computer writes commands and data to and reads status and data from.

ADDRESS	FUNCTION	ADDRESS	FUNCTION
Base	D/A0 LSB	Base + 8	D/A4 LSB
Base + 1	D/A0 MSB	Base + 9	D/A4 MSB
Base + 2	D/A1 LSB	Base + 10	D/A5 LSB
Base + 3	D/A1 MSB	Base + 11	D/A5 MSB
Base + 4	D/A2 LSB	Base + 12	PORT A Out/ In
Base + 5	D/A2 MSB	Base + 13	PORT B Out/ In
Base + 6	D/A3 LSB	Base + 14	PORT C Out/ In
Base + 7	D/A3 MSB	Base + 15	8255 Control

BASE ADDRESS SWITCH

The CIO-DDA06 occupies 16 consecutive I/O addresses. The first, or Base Address, is set by a bank of switches in a DIP switch on the board. It is possible to set the base address of the CIO-DDA06 anywhere within the range 0 to 3FF Hex. Because of this flexibility, multiple CIO-DDA06 boards, or other I/O boards, may be used in the same PC.

BASE ADDRESS SWITCH

SETTINGS SHOWN - 300 HEX, 768 DECIMAL

	SW	DEC	HEX
	9	512	200
	8	256	100
	7	128	80
	6	64	40
	5	32	20
	4	16	10

9 8 7 6 5 4
UP
DN

SPECIFICATIONS

Channels	6 Voltage Output
Resolution	CIO-DDA06/12, 12 Bit, 1 part in 4,095
	CIO-DDA06/16, 16 Bit 1 part in 65,535
D/A Type	Dual DAC, AD7237 (12 Bit), DAC725 (16 Bit)
Latches	Double buffered/Sim. Update
Linearity	+/- 1/2 Bit (12 Bit), +/-0.006% FS (16 Bit)
Monotonicity	+/- 1/2 Bit (12 Bit), 14 Bit over Temp Range(16 Bit)
Temperature drift	1ppM Typ., 3ppM Max @ 0V
	15ppm Typ., 30ppM max @ FS
Load Current	+/-5mA Max
Short Circuit Current	40mA Max
Output Resistance	<0.1 ohm
Settling Time + FS 0.01%	3uS Typical, 5uS Max (12 Bit), 8uS (16 Bit)
Settling Time -FS 0.01%	5uS Typical, 10uS
OUTPUT RANGES	
CIO-DDA06/12	+/-10, +/-5, +/-2.5, +/-1.67 Bipolar Volts
	0-10, 0-5, 0-2.5, 0-1.67 Unipolar Volts
CIO-DDA06/16	+/-10, +/-5, +/-2.5 Bipolar Volts
	0-10, 0-5 Unipolar Volts
DIGITAL I/O	
I/O Ports	2 Eight Bit, 2 Four Bit
Total Bits	24
Output High	2.4V Min @ 2.5mA
Output Low	0.5V Max @ 2.5 mA
Input High	2.0V Min, 7.0V Max
Input Low	-0.5V Min, 0.8V Max

ORDERING GUIDE

6 Channel, 16 Bit, D/A, Digital I/O	CIO-DDA06/16
6 Channel, 12 Bit, D/A, 24 Digital I/O	CIO-DDA06/12
24 Channel Solid State Relay Rack	SSR-RACK24
8 Channel Solid State Relay Rack	SSR-RACK08

Screw Terminal Boards
16" X 4" all signals from one 37 D plus proto area & circuitry.	CIO-TERMINAL
4" X 4" all signals from one 37 D connector.	CIO-MINI37
16" X 4" all signals from one 37D, Spade Lug Terminals.	CIO-SPADE50

Cables
2 foot ribbon cable, 37 conductor, female connectors.	C37FF-2
'N' foot ribbon cable, 37 conductor, female connectors.	C37FF-N
5 foot shielded cable, molded female connectors, 37 cond.	C37FFS-5
10 foot shielded cable, molded female connectors, 37 cond.	C37FFS-10

CIO-DAC02

2 Channel 12 Bit Digital To Analog Voltage or 4-20 mA Output

2 AD7548 MULTIPLYING DIGITAL TO ANALOG CONVERTERS

ON BOARD REFERENCE VOLTAGE JUMPERS

2 INDEPENDENT ANALOG OUTPUTS OF
0 to 5 VOLTS
0 to 10 VOLTS
+/- 5 VOLTS
+/- 10 VOLTS
4-20 mA CURRENT

BASE ADDRESS SWITCH BOARD USES 4 ADDRESSES

25 PIN D TYPE CONNECTOR

PC/XT/AT BUS INTERFACE

DESCRIPTION

The CIO-DAC02 is a versatile analog output plug in board which may be used to control voltage devices with ranges of 0-5, 0-10, +/-5, and +/-10 volts. In addition, 4-20 mA loops may be controlled directly with no additional circuitry.

Each analog output is controlled by a precision 12 bit digital to analog (D/A) converter. A 12 bit converter provides 1/4095 parts resolution. On a scale of 0-5 volts, output can be controlled to within 1.22mV.

The D/A converter's output range may also be controlled by providing an external DC or AC reference voltage. The D/As are multiplying type and the output range is equal to the reference

voltage and of the opposite sign. A -5V Ref = 0-5V output.
The CIO-DAC02 is easy to program from any language using port output commands. Each D/A occupies two 8 bit addresses for a total of 4 for the board. The output of the D/A is updated whenever the MSB is written, a technique known as double buffering.

The CIO-DAC02 is provided with software for calibration and test and supported by Universal Driver, CTOOLS and TTOOLS high level language programming libraries as well as the menu driven Control-CB, Labtech Notebook and other third party software

CIO-DAC02 BLOCK DIAGRAM

-10V REF
-5V REF
BIPOLAR
UNIPOLAR
4-20 mA
D/A 0 Vref

-5V REF
D/A 0
LATCH
AMP

-10V REF
D/A 1
LATCH
AMP
D/A 1 Vref
BIPOLAR
UNIPOLAR
4-20 mA

BASE ADDRESS SWITCH
CHIP SELECT
TRANSIEVERS

PC/XT BUS
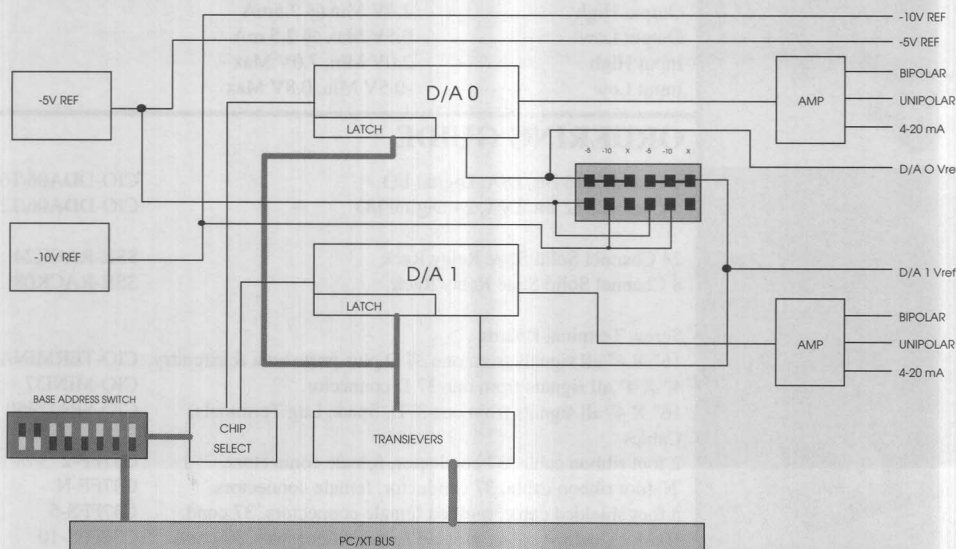
CIO-DAC02 CONNECTOR

VIEW FROM REAR OF PC

Pin	Signal	Pin	Signal
GND 1		14	-10V REF OUT
LLGND 2		15	-5V REF OUT
LLGND 3		16	D/A1 Vref INPUT
LLGND 4		17	D/A1 BIPOLAR
LLGND 5		18	D/A1 UNIPOLAR
LLGND 6		19	D/A1 4-20mA
LLGND 7		20	-10V REF OUT
LLGND 8		21	-5V REF OUT
LLGND 9		22	D/A0 Vref INPUT
LLGND 10		23	D/A0 BIPOLAR
LLGND 11		24	D/A0 UNIPOLAR
LLGND 12		25	D/A0 4-20mA
+5V PC 13			

Call for Friendly Technical Assistance - (508) 261-1123
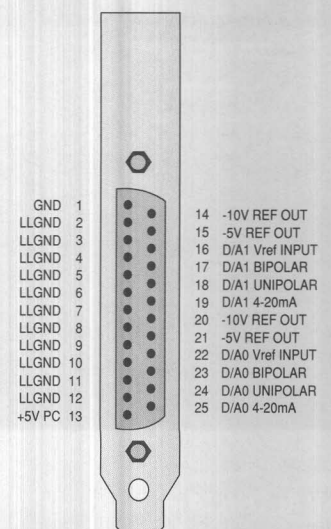
BASE ADDRESS SWITCH

The CIO-DAC02 address is set by an 8 position dip switch located on the board. The dip switch allows the CIO-DAC02 to be located at any address on a 4 bit boundary.

Address 300H shown

SW	HEX
A9	200
A8	100
A7	80
A6	40
A5	20
A4	10
A3	8
A2	4

9 8 7 6 5 4 3 2
↓ ↓ ↑ ↑ ↑ ↑ ↑ ↑
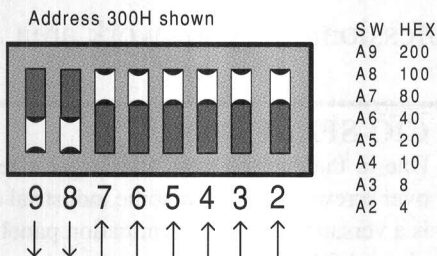
I/O PORT MAP

The CIO-DAC02 occupies four consecutive I/O ports in the PC's I/O address space, beginning with the board's base address.

Base Address	+0	D/A0	Low Byte
	+1	D/A0	High Byte
	+2	D/A1	Low Byte
	+3	D/A1	High Byte

D/A PORT DATA FORMAT

Each D/A is controlled by data written to two I/O ports. The format of the data is the same for each D/A.

LSB	D7	D6	D5	D4	D3	D2	D1	D0
	B9	B10	B11	B12	X	X	X	X

MSB	D7	D6	D5	D4	D3	D2	D1	D0
	B1	B2	B3	B4	B5	B6	B7	B8

PROGRAMMING THE CIO-DAC02

The CIO-DAC02 is easily programmed from any language which supports output to I/O ports. Each D/A occupies two 8 bit addresses, for example , D/A0 occupies the addresses at the board's base address (LSB), and base + 1 (MSB). To output a voltage with the CIO-DAC02, the desired voltage output must first be split into the LSB and MSB then written to the ports.

```
10 VOLTAGE = 2.25                        'Desired output voltage is 2.5V
20 ADCOUNTS% = INT(2.25 / 0.00122)       'Convert volts to bits, 0-5V FS
30 MSB% = INT(ADCOUNTS% / 16)            'Find MSB
40 LSB% = (ADCOUNTS% - MSB% * 16)        'Find LSB
50 LSB% = 16 * LSB%                       'Shift LSB 4 places left
60 OUT &H300, LSB%                        'Output LSB, D/A unchanged.
70 OUT &H301, MSB%                        'Output MSB, D/A now = 2.25V
```

This simple BASIC example can be directly translated to any other language, such as C or TURBO PASCAL.

SOFTWARE

The CIO-DAC02 is supported by:

Universal Driver	CTOOLS
Control CB	TTOOLS
LabTech Notebook	Any Language with
LabTech Control	Port Output

Any software which supports the MetraByte DAC-02 automatically supports the CIO-DAC02.

SETTING OUTPUT RANGES

The output range of the CIO-DAC02 may be set by placing shorting blocks on the jumpers provided on board or by connecting the several reference voltage outputs to the D/A Vref input at the 25 pin D connector.

The output range jumper block is shown here. One of the ranges provided may be selected or the jumper may be placed in the X position if an external reference will be provided.

OUTPUT RANGE SELECT JUMPER BLOCK

D/A 0   D/A 0
-5 -10 X   -5 -10 X

JUMPERS IN -5V REF POSITION
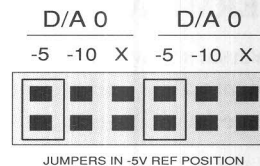
Once the reference voltage is chosen, the output of the D/As is available on three of the 25 pin connector's output pins. The three outputs are Unipolar, Bipolar and Current.

V Ref	Unipolar	Bipolar	Current
-5	0 to 5V	+/-5V	4-20mA
-10	0 to 10V	+/-10V	
Ext.	2 Quadrant	4 Quadrant	

Once the output range is chosen the voltage or current output is controlled by writing a value between 0 and 4095 to the D/A converter. The relationship of the D/A digital data to the voltage output is different for unipolar and bipolar ranges.

A 0 D/A value corresponds to 0 volts unipolar and +full scale (+FS) bipolar. A 4095 D/A value corresponds to +FS unipolar and -FS bipolar. The following table applies for Vref = -5V

D/A Value	Unipolar	Bipolar
0	0.0V	+5.0V
2048	2.5V	0.0V
4095	5.0V	-5.0V

ORDERING GUIDE

2 channel, 12 bit analog output plug in board	CIO-DAC02
Connector kit for constructing a cable	DMCON-25

SPECIFICATIONS

CHANNELS	2
Resolution	12 bits, 1 part in 4095
Relative accuracy	1/2 LSB 0.01% Max.
Differential Linearity	1/2 LSB Max.
On-board reference ranges	0 to 5V, 0 to 10V
	+/-5V, +/-10V
	4-20mA current loop
External reference voltage	+/-10 Max
Voltage output impedance	< 0.1 ohm Max.
V output drive current	+/-5 mA Min.
4-20 mA compliance	8-36 V
Settling time, full scale step	150 uS to 0.001% typ.
Power Consumption	5V @ 100 mA Max.
	+/-12V @ 25/35mA Max.

SCREW TERMINAL BOARDS

Ease signal connection & professionalize your work area

CIO-TERMINAL

This universal screw terminal accessory provides easy signal connection to miniature screw terminals which accept 12-22 American Wire Gauge (AWG) wires.

Any I/O board with a 37 pin signal connector may employ the CIO-TERMINAL for signal termination. Its large size (16" X 4") make it ideal for bench or rack mounting. A generous prototype area is complemented by circuitry for voltage dividers, low pass filters and pull up resistors. These extra circuits are frequently used to condition signals, and may be populated by you with exactly the right components for the application. The circuitry and component selection is fully explained in the plug-in board users manual.

Two 37 pin D type connectors provide 1:1 feed through to other accessory boards.

CIO-SPADE50

Due to their ruggedness and larger size, spade lugs are preferred over screw terminals by some industrial customers. The SPADE50 is a versatile 16" X 4" termination panel which mates with both 37 pin and 50 pin connectors.

Spade lugs are available from Radio Shack and industrial hardware suppliers. A spade lug is crimped onto each signal wire. The spade lug and signal wire are then mounted on the SPADE50.

CIO-TERM100

For high density termination of the digital signals from a CIO-DIO48, DIO96 or DIO192, the 100 point, 16" X 4" TERM100 does the job. Because the TERM100 is designed to be used only with a digital I/O board, positions for pull up resistors are on the board. Each of the two 50 pin connectors carry 48 digital I/O lines, +5V PC power and ground.

CIO-TERMINAL   CIO-SPADE50   CIO-TERM100

Call for Friendly Technical Assistance - (508) 261-1123
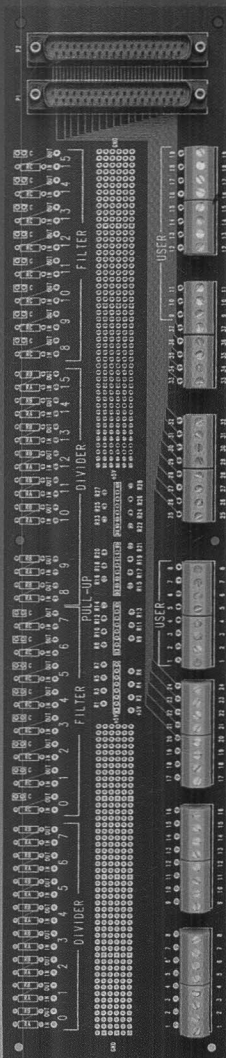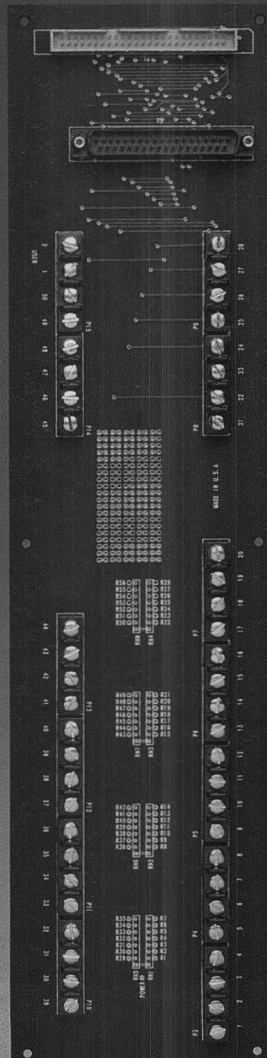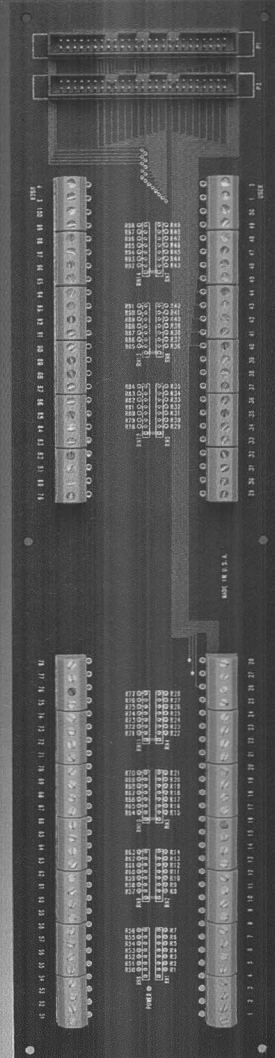
CABLE CONSTRUCTION KITS

Cables may be constructed from your choice of signal wire and a connector kit. The connector kits, DFCON-37 and DMCON-25 consist of a 37 or 25 pin 'D' connector, crimp pins and a shell. The crimp pins are crimped onto your signal wire then pushed into the 'D' connector. A shell protects and professionalizes the assembly. Shown below is the DFCON-37.

DFCON-37

CIO-MINI37 & CIO-MINI50

The economical CIO-MINI37 is just the screw terminal accessory for tight places; or tight budgets. Measuring only 4" by 4", the CIO-MINI37 mates with the C37FF series of cables and thereby to any I/O board with a 37 pin connector.

It is truly a universal screw terminal accessory because all the signals from the 37 pin connector are brought directly to a numbered 12-22 AWG screw terminal. The number on the screw terminal corresponds to the number on the 37 pin connector.

The CIO-MINI50 provides the same functionality and size for I/O boards that employ the 50 pin header connector.

MADE IN U.S.A.
P1
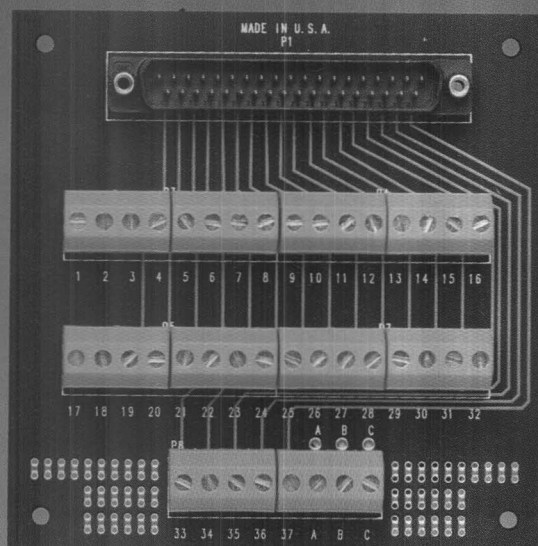
CUSTOMIZED SCREW TERMINATION PANELS

Signal routing and termination can be a hassle. It seems that nobody makes exactly what you need, or they charge an arm and a leg!

Let ComputerBoards, Inc. build the screw terminal board that suits your application perfectly. FAX us your drawing and get a quote back the same day!

Shown below is a custom screw terminal board we designed for one of our customers who has previously designed in the MetraByte STA-08. We have also produced special termination panels for injection mold control systems and other industrial applications.

No matter what you need or how much you pay for what you currently buy, we can save you money. Please call soon.

CIO-STA08
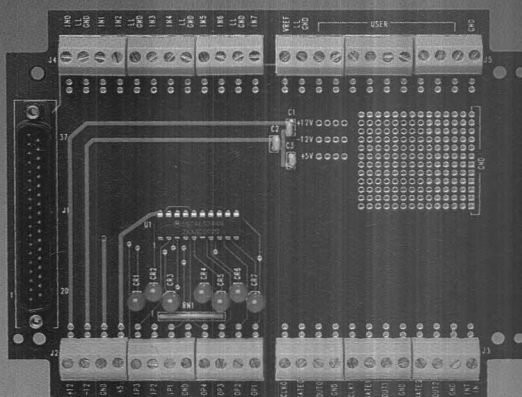
PG408 DC/DC CONVERTER

Some accessory boards require +/-15V to power analog components. Occasionally, prototype circuitry may require +/-15V also. The PG408 DC/DC converter converts the personal computer's +5V into +/-15V at 33mA each. The PG408 plugs into sockets designed for it on accessory boards such as the CIO-SSH16 and CIO-EXP32, or may be wired into prototype area on your screw terminal board.

A NOTE ON CABLES & CONNECTORS

The cables we offer are universally equipped with female connectors at each end. The female connectors on the cable are intended to mate with the male connectors found on I/O boards and screw terminal and signal conditioning accessories.

The male connector is always mounted on the board because, of the two, the female connector is more likely to wear out. The tiny sockets in a female connector spread with frequent insertions and removals, eventually resulting in too loose a fit for a good signal. It is more economical to replace a cable than a board.

CABLE SELECTION GUIDE
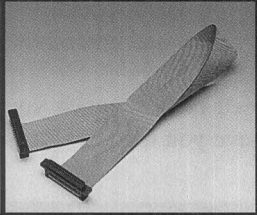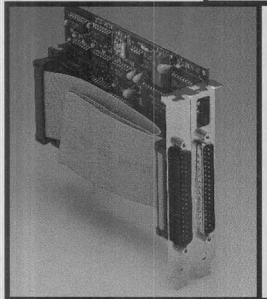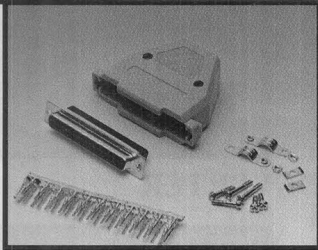
37 CONDUCTOR CABLES

SHIELDED OR RIBBON

Two types of 37 conductor cables are available; ribbon cables with IDC connectors and shielded round cables with molded connectors. Ribbon cables may be ordered in any length from 6 inches to 100 ft. Shielded round cables are available from stock in lengths of 5 and 10 feet only.

A shielded cable is a better choice for most analog connections and is required in some cases, such as when connecting a CIO-SSH16 to a CIO-DAS16. On a cost comparison basis, the shielded cable is a better value.

CUSTOM LENGTHS

Ribbon cables of varying lengths may be ordered by assembling a cable part number that designates the length you desire. For example, the standard C37FF-2 is a 2 foot cable. A C37FF-7 would be a 7 foot cable. The price-per-foot of extra cable can be found in the price list. The letters FF designate female connectors at each end. Cables are available MM and MF also.

C37FFS-5

C37FF-2

BP37

DFCON-37

CABLES

Use these part numbers to order 37 conductor cables.

C37FF-2	37 Conductor Ribbon 2 Foot
C37FF-##	37 Conductor Ribbon Custom Length
C37FFS-5	37 Conductor Shielded 5 Foot
C37FFS-10	37 Conductor Shielded 10 Foot
C-MUXAD16-10	37 Con. DAS16 to EXP cable.
BP-37	Internal Cable-to-Bracket Assy.
BP-40	cSBX Connector-to-bracket assy.
DFCON-37	37 Pin Connector, Shell & Pins
DMCON-25	25 Pin Connector, Shell & Pins

PLEASE SEE THE PRICE LIST FOR PRICES

BOARD LIST

The number of pins on an I/O board's or accessory board's connector(s) is always called out in the data sheet for that board. You will find the correct cable for a particular board listed in the ordering guide on the I/O board data sheet.

AUXILIARY POWER CABLES

Some accessory boards require more +5V power than can be carried in a strand of ribbon cable. For those boards we have added a Molex connector, identical to that found inside the personal computer. Just connect a CMOLEX-10 cable to your CIO-SSH16, SSR-RACK24, ISO-RACK08 or other accessory and connect the other end to the accessory power connectors found inside the PC, attached to the switching power supply!
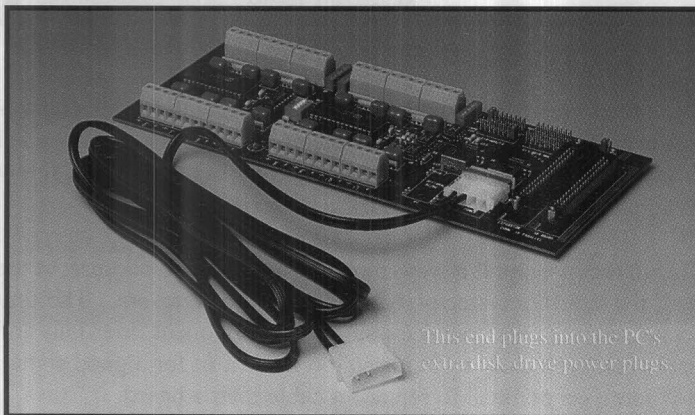
This end plugs into the PC's extra disk drive power plugs

IEEE-488 CABLES

Instrumentation set-ups require high quality cables. In the past IEEE-488 cables have had high prices as well. The C488-2M, 2 meter GPIB interface cable breaks new ground in low price, high quality cabling for IEEE-488 instrumentation interfacing. Constructed of shielded round cable with molded connector housings, the C488-2M will withstand a lot of abuse. This cable was introduced to compliment Computer Boards' very low cost IEEE-488 interface, the CIO-PC2A, but is suitable for use with any GPIB instruments or interface boards. ORDER part# C488-2M.
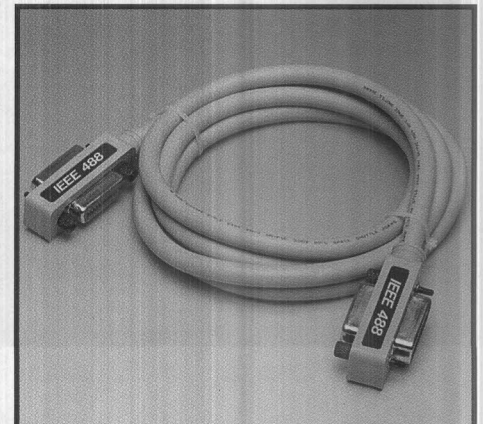
50 CONDUCTOR CABLES
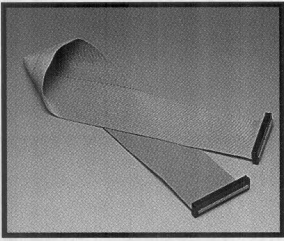
C50FF-2

High density digital boards require 50 conductor cables. These cables are terminated with insulation displacement connectors (IDC) which mate with the high density, 0.1" centered connectors found on boards such as the CIO-DIO96.

CUSTOM LENGTHS

Ribbon cables may be ordered in custom lengths. We recommend lengths of no more than 100' nor less than 1'. To order a custom length, 50 conductor cable, add the length of the cable you desire to the part number. For example, a C50FF-2 is a 2 foot cable. A C50FF-25 is a 25 foot cable. Please see the price sheet for pricing of standard and custom length cables.

BOARD LIST

The CIO-INT32, CIO-OPTO48, CIO-DISO48, CIO-DIO48, CIO-DIO96 and CIO-DIO192 require 50 pin cables. The accessory boards:
CIO-TERM100,
CIO-SPADE50,
SSR-RACK24,
CIO-ERB24
will accept 50 pin cable connectors.
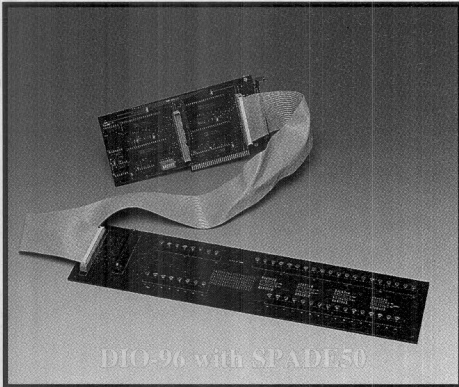
DIO-96 with 4 SSR-RACK24s

CABLES FOR MULTIPLEXORS & SIGNAL CONDITIONING ACCESSORIES

INTERFACING TO CIO-DAS08 TYPE A/D BOARDS

The analog multiplexor accessory boards, CIO-EXP32 and CIO-EXP16, and isolation rack, ISO-RACK08, are designed to interface directly to the CIO-DAS08 or PPIO-AI8.
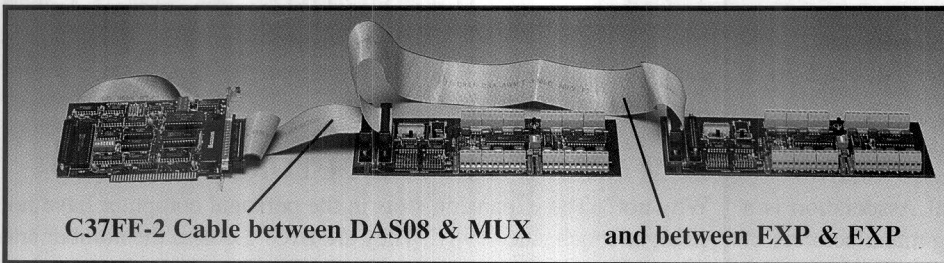
C37FF-2 Cable between DAS08 & MUX　　**and between EXP & EXP**

INTERFACING TO CIO-DAS16 TYPE A/D BOARDS

The analog multiplexor accessory boards, CIO-EXP32 and CIO-EXP16, and isolation rack, ISO-RACK08, require a special cable, the C-MUXAD16-10, to interface to the CIO-DAS16.
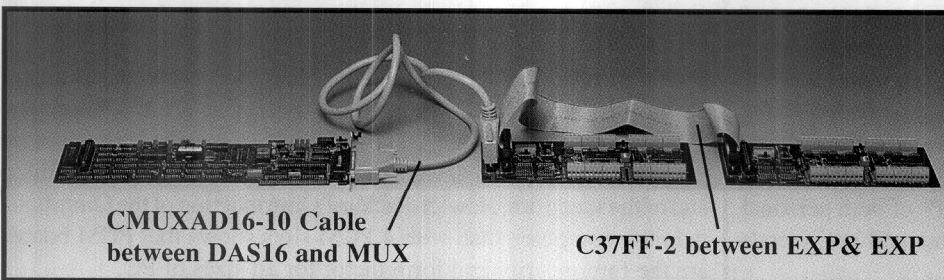
CMUXAD16-10 Cable between DAS16 and MUX　　**C37FF-2 between EXP& EXP**

BOARD/CABLE LIST

CIO-DAS08 to	CIO-EXP##	C37FF-##
		C37FFS-#
CIO-DAS08 to	ISO-RACK08	C37FF-##
		C37FFS-#
CIO-DAS08-PGH	CIO-EXP##	C37FF-##
		C37FFS-#
CIO-DAS08-PGH	ISO-RACK08	C37FF-##
		C37FFS-#
CIO-DAS16 to	CIO-EXP##	C-MUXAD16-10
CIO-DAS16 to	ISO-RACK08	C-MUXAD16-10
CIO-DAS16 to	CIO-SSH16	C37FFS-#
CIO-DAS16 to	ISO-RACK16	C37FFS-#

Includes all I/O boards with DAS16 in part number.

CIO-EXP## to	CIO-EXP##	C37FF-2
CIO-EXP## to ISO-RACK08		C37FF-2
TERMINAL to	CIO-EXP##	C37FF-2

PCMCIA Data Acquisition

Data Acquisition & Control Via The New PCMCIA Accessory Slots

The Background on PCMCIA

PCM ANALOG & DIGITAL I/O

With the May 1993 introduction of the PCM-DAS08 and PCM-D28C3, ComputerBoards became the first to offer data acquisition interfaces for the PCMCIA slot.

PCMCIA?

Personal Computer Memory Card International Association is a standards committee formed in 1989 by leading manufacturers of personal computer components. Initially intended as a standard for removable memory cards, it quickly expanded in size and scope to include Fax Modems, LAN Interfaces, Cellular Uplinks and now, Data Acquisition Interfaces.

WHAT DOES IT LOOK LIKE?

Where does it go? If you are new to PCMCIA, and who isn't, you may be asking simple questions about size, placement, technology, software and cost. This PCM card introduction is for you.

The PCM card is a personal computer accessory which follows a rigid specification governing size, power, signal and software standards. Standards which allow manufacturer's of both personal computers and peripherals to guaranty platforms and peripherals will work together.

As for the size of a PCM card, it could hide under a mouse! And for where it goes, the photograph above shows an NEC Versa laptop computer with a PCM-DAS08 taking readings from an SO2 sensor in a discarded oil drum.

PCM CARDS ARE THE FUTURE

Why not? The expansion slots in the personal computer have not changed much since 1981. They are BIG. Look at the number and size of the components required to build a fast motherboard today. Now look at the number of components on our CIO-DIO24; and the size of the CIO-DIO24. It is only big so it will fit in the expansion slot. Throughout the PC industry the trend is clear. PCs will become smaller and use less power. As they do, the expansion slot must keep pace. PCM is that trend.

NOT JUST LAPTOPS

IBM's introduction of the "Green PC" heralded a new generation of desktop computers. Low power and small size are the hallmarks. The presence of 4 PCMCIA Type 2 slots, two in front and two in the rear, show where the PCMCIA standard is headed. At the palmtop end of the spectrum, Hewlet-Packard's introduction of the Omnibook palmtop computer, also with 4 PCM slots shows that PCM boards are the future peripheral form factor for all sizes of PC.

Call for Friendly Technical Assistance - (508) 261-1123

THE COMPUTERS

Pictured here is the NEC Versa laptop computer. The is state of the art laptop technology! The screen will detach and face away from the keyboard for demonstrations, or fold down over the keyboard for pen computing. The new IBM "Green Computer" (for environmentally friendly) represents the cream of the crop in desktop PCMCIA machines and the new HP Omnibook the very best in palm top computers. Here is a partial list of the computers with PCMCIA slots.

AST	PowerExec 83	Sharp	PC-6891
Canon	Innova NX	Toshiba	T4500C
IBM	ThinkPad 710T, 720		
GRiD	Convertable		
MEI	WinBook		
PI Systems	Infolio		

THE TECHNOLOGY

PCM cards are small. Circuit board area is at a premium and the height restrictions preclude the use of through-hole components (like the ICs and resistors you see on a CIO board). To meet the height restriction and put a useful number of functions on a card PCM cards must use surface mount technology.

Shown here is a close-up of the components on a PCM-DAS08. You can see they are small and soldered directly to the printed circuit board. Also take note of the smaller connector and the metal case.
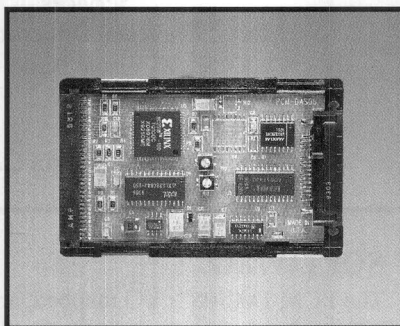
PCM technology is the technology of the future, and like most advanced designs, SMDs, small connectors and metal cases are more expensive than standard I/O board components. *The prices will come down!* There is less material in these small designs and as volumes climb to those of through-hole technology, the prices will fall. We predict the prices of PCM cards will eventually be less than that of today's ISA bus cards.

THE STANDARD

PCMCIA Headquarters, 1030G East Duane Ave, Sunnyvale, CA 94086 (408) 720-0107 can provide you with information on PCMCIA and membership in the PCMCIA manufacturers group. ComputerBoards is a member.

There are currently three PCM card form factors. Type I is the original 3.3mm thick card. Type II expands the width only out to 5.0mm and Type III expands width to 10.5mm. Computers equipped with PCM slots are tending toward a pair of Type II slots one above the other; a configuration that will accept 2 Type I, 2 Type II or one Type III PCM card.

The PCM interface to the PC is fixed for all Types and is largely reconfigurable through software once the card is installed (see card & socket services). This allows for "hot" insertion and removal.

ComputerBoards has the first PCMCIA data acquisition cards; and the prices will not be beat!

THE SOFTWARE

PCM card software from ComputerBoards is in two layers, Card & Socket Services (C&SS). C&SS manages communication between the computer's PCMCIA controller and the PCMCIA card you install. C&SS is specific for the PCM card. C&SS manages both hardware and software providing for hot insertion and removal of PCM cards and reconfiguring the signal and power pins to match those of the PCM card.

Once C&SS is installed, the PCM card's control registers may be addressed as I/O registers. You can write to and read from the PCM card's function registers directly from any language that supports port I/O.

CALIBRATION AND TEST

PCM card technology provides no access to calibration potentiometers or test points when the card is fully assembled and installed in the PC. To test or calibrate the PCM card an extender is needed and the cover must be removed. A complete calibration and test package is available from ComputerBoards.

THE APPLICATIONS

Picture a compact, self contained portable data acquisition and analysis system. You might consider using it for remote data gathering or in-vehicle testing. You might use it for occasional fault monitoring at turbine generators or factory equipment.

In fact, portable computers are everywhere. You might use one at your desk so you can take work home or with you when you travel. If you have a portable, why not gather data with the same computer you will analyze it on? Even if it never leaves you desk, a PCM card is smaller and poised to take advantage of future technology.

SCREW TERMINALS & CABLES

Screw terminal boards and cables for 15 pin PCM connectors and 33 pin PCM connectors. The small connectors on PCM boards are unique, so you should purchase cables from ComputerBoards.

The PCM-TERM15 is a 15 position screw terminal board mounted in a plastic case. A 10" fifteen conductor cable with a PCM-DAS08 mating connector is attached to the PCM-TERM15. Screw terminals will accept 12 to 22 AWG wire.

The PCM-TERM33 is a 33 position screw terminal board designed for PCM boards with 33 conductor connectors. The PCM-TERM33 is mounted in a plastic case and is equipped with a 10" cable and connector designed to mate with a PCM-D28/C3.

The PCM-C15-10" is a 10" cable with a 15 pin connector on one end. The PCM-C33-10" is a 10" cable with a 33 pin connector on one end.
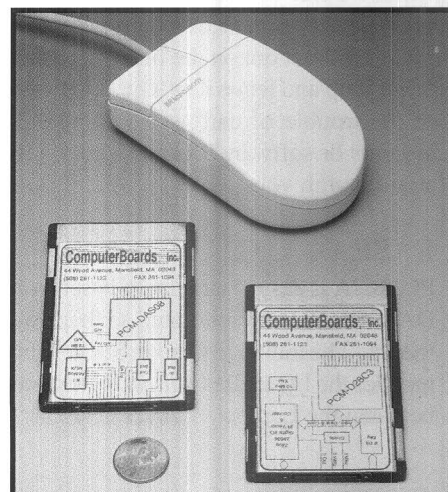
PCM-DAS08™

8 Channel Analog Input, 3 Digital Output & 2 Digital Input   PCMCIA Type II
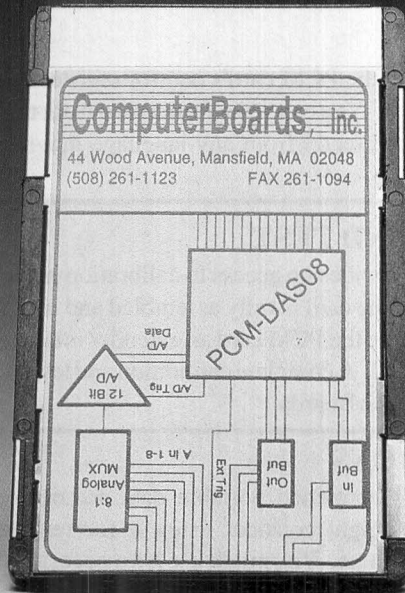
Side
View

FEATURES

HARDWARE

8 Channels analog input, single ended
12 Bit, 1 part in 4095
20,000 samples per second throughput
Automatic 16 or 8 bit bus interface
25 uSec. A/D
+/-5V Standard, +/-0.5V & +/-0.05 available
Internal or external A/D trigger
2 CMOS digital inputs
3 CMOS digital outputs
PCMCIA Type II compliant
AMP subminiature 15 pin connector

SOFTWARE

Installation & Test
Card Socket Services
DOS: Universal Driver for:
    Quick & Visual Basic, C, Pascal
Windows DLL
    Visual Basic
Supported by Vis-Sim DACQ

PCMCIA DATA ACQUISITION

The PCM-DAS08 is a test and measurement accessory for your laptop computer. Connect to voltage, current, temperature, pressure, flow or any other process variable. Sense contact closures and event triggers. Control relays, alarms and indicators.

Many of the new laptop computers have PCMCIA expansion slots, and some of these are Type II or Type III (the older Type I is too slim for data acquisition). The PCM-DAS08 will connect with either Type II or III PCMCIA expansion slots!

APPLICATIONS

The PCM-DAS08 and software, such as Vis-Sim DACQ for windows can convert your laptop into a sophisticated measurement instrument for on-board vehicle testing, even in aircraft or boats! Take it out on the plant floor for an equipment spot check, or set it up and leave it as a mobile trouble shooting rig, with none of the trouble of carting a PC around. Do you consult or sell systems or software? Carry a complete data acquisition demonstration with you.

EASE OF USE

PCMCIA is easy to use. Installation is a snap; literally! The PCM-DAS08 is factory calibrated so there are no switches to set or pots to turn. The included Card & Socket Services installation software handles the I/O addressing and completes the communications link between the Laptop and the PCM-DAS08.

SOFTWARE

The PCM-DAS08 is I/O mapped, and after installation of Card & Socket Services, may be addressed and controlled from any language or applications program. ComputerBoards Universal Driver (UNIV-DRV) supports Quick and Visual Basic, C and Turbo Pascal. A Windows DLL for Visual Basic will be released in October 1993.

For programing Windows applications, choose Vis-Sim DACQ, a complete graphical data acquisition, display and analysis system.

BLOCK DIAGRAM
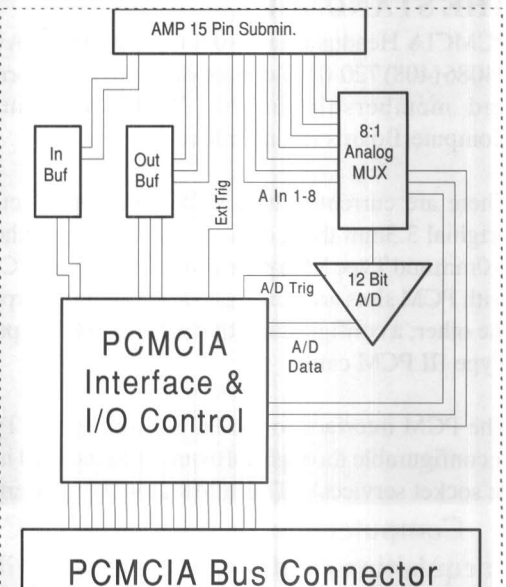
The 12 bit A/D converter provides a resolution of 1/4095 parts of full scale. An input range of +/-5 volts is standard. The PCM-DAS08 may be ordered in +/-0.5 or +/-0.05 as well. The range is set during manufacture and may not be changed in the field.

TRIGGERING

A Trigger is the event that begins an acquisition/transfer cycle. There are two ways to trigger a PCM-DAS08; software or external. The trigger source, software or external, is programmable.

A software trigger provides synchronization to an internal time base, such as the system clock or internal service routines. Using an external trigger allows you to synchronize samples to an external event. The external trigger may be rising or falling edge

A/D SPECIFICATIONS

|	
Resolution	12 Bit, 1 part in 4096
Channels	8 Single Ended
A/D Type	Successive Approx.
Conversion Time	25 uS
Accuracy	0.01% +/- 1 LSB
Integral Linearity	+/- 1 LSB
No missing codes guaranteed over temp. range.	
Maximum Overvoltage	+/- 35V Continuous
Input Leakage Current	250 nA Max @ 25°C
Gain Drift	+/- 25 ppm/Deg C Max
Zero Drift	+/- 10 ppm/Deg C Max

SCREW TERMINALS & CABLES

University & commercial laboratory applications mean frequent signal changes and experiment re-wiring. A screw terminal board mounted on your bench, or up on the wall behind the bench, provides a clean, professional approach to experiment wiring.

Screw terminals, such the PCM-TERM15 accommodates 12-22 AWG wire.

11	Digital Out 2
12	Digital Out 3
13	A/D External Trigger. Falling Edge
14	Digital Input 1
15	Digital Input 2

DIGITAL I/O

The PCM-DAS08 has 3 digital outputs and 2 digital inputs (CMOS). In addition, a dedicated input is for externally triggering the A/D converter.

Input Logic Low = -0.5 to 0.8   Logic High 3.0 to 5.0 Max
Input i = 10uA, Output Low Sink = 1.7mA, Source = -200uA

I/O & CONTROL REGISTER MAP

The PCM-DAS08 is a PCMCIA interface card and conforms to Type II specifications. PCMCIA (Personal Computer Memory Card International) is a special system of I/O expansion originally designed to provide Laptop Computers with removable memory and programs (Type I). The specification has been expanded to Type III in order to accommodate thicker cards with more capability. Examples are the Kitty Hawk 1.8" hard disk from HP (Type III) and the PCM-DAS08 (Type II).

PCMCIA cards require Card & Socket Services software be installed so the CPU will know how to handle requests and transfers to and from the PCMCIA board. Card & Socket Services software is included with the PCM-DAS08.

Once the C&SS software is installed, I/O programs communicate with the PCM-DAS08 through a set of I/O registers shown here.

I/O ADDR.	PCM-DAS08 FUNCTION R | W
BASE + 0	A/D Low Byte | Start A/D
BASE + 1	A/D High Byte | NA
BASE + 2	A/D Status | I/O Trig. R/F Edge, Ch Set
BASE + 3	Digital Input | Digital Output

ORDERING GUIDE

PCM-DAS08 multifunction A/D board.

8 Ch A/D, 3 Dig. Out, 2 Dig. In	PCM-DAS08
DOS Language Interface, Basic, C, Pascal	UNIV-DRV
4" X 4" screw terminal board for 15 pin PCM with 10" cable atached.	PCM-TERM15
Cables 10" cable, 15 conductor & ground, female connectors.	PCM-C15F-10I

PCM-D28C3™

28 Digital I/O, 16 Vectored Interrupt, 3 16 Bit Counters   PCMCIA Type II
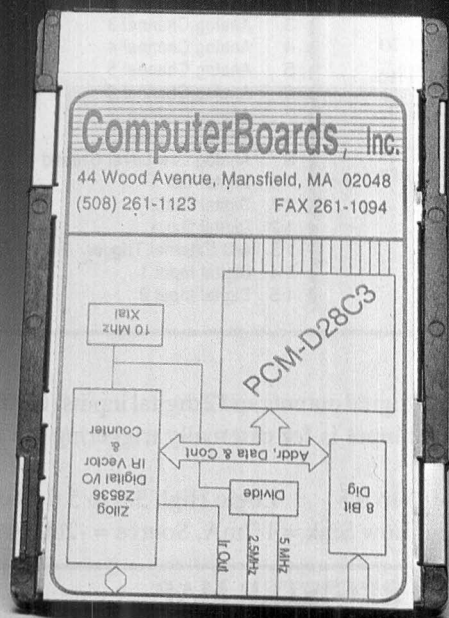
FEATURES

HARDWARE (Programmable Configuration)

20 CMOS bit programmable digital I/O
8 CMOS digital outputs
or
16 Vectored Interrupt Inputs
8 CMOS digital outputs
or
3, 16 bit up/down programmable counters
8 CMOS digital outputs

PCMCIA Type II compliant
AMP subminiature 33 pin connector

SOFTWARE

Installation & Test
Card Installation & Register Mapping
DOS: Universal Driver for:
    Quick & Visual Basic, C, Pascal
Windows DLL
    Visual Basic
Supported by Vis-Sim DACQ

Side
View

PCMCIA DDIGITAL INTERFACING

The PCM-D28C3 is a complete digital interfacing system for your Laptop computer. Sense contact closures and event triggers. Control relays, alarms and indicators. Count events and measure frequency. The PCM-D28C3 is programmably reconfigurable for:

THREE, 16 BIT COUNTERS WITH IN, OUT, GATE AND TRIGGER PATTERN MATCHING
INVERTING OR NON INVERTING INPUT AND OUTPUT
RISING OR FALLING EDGE OR HIGH OR LOW LEVEL TRIGGER/SENSE
TWO WIRE OR THREE WIRE HANDSHAKING DIGITAL INTERFACE

Many of the new laptop computers have PCMCIA expansion slots, and some of these are Type II or Type III (the older type 1 is too slim for data acquisition). The PCM-D28C3 will connect with either Type II or III PCMCIA expansion slots!

APPLICATIONS

The PCM-D28C3 and software, such as Vis-Sim DACQ for windows can convert your laptop into a digital interface controller. Measuer frequency, encoder position, V-to-F sensors for mobile testing or routine quality checks. Do you consult or sell systems or software? Carry a complete data acquisition demonstration with you.

EASE OF USE

PCMCIA is easy to use. Installation is a snap; literally! There are no switches to set or jumpers to install. The included Card & Socket Services installation software handles the I/O addressing

and completes the communications link between the Laptop and the PCM-D28C3.

SOFTWARE

The PCM-D28C3 is I/O mapped, and after installation of Card & Socket Services, may be addressed and controlled from any language or applications program. The Universal Driver (UNIV-DRV), ComputerBoards universal driver for DOS languages, supports Quick and Visual Basic, C and Turbo Pascal. A Windows DLL for Visual Basic will be released in October 1993.

BLOCK DIAGRAM

Call for Friendly Technical Assistance - (508) 261-1123
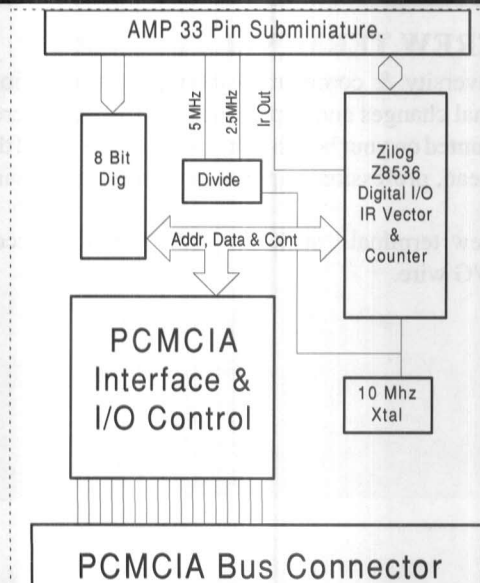
FUNCTIONAL DESCRIPTION

The PCM-D28C3 is possibly the most powerful digital I/O accessory available for the PCMCIA equipped laptop computers. The heart of the PCM-D28C3 is a Zilog Z8536 programmable digital I/O chip. The Z8536 contains a number of different internal machines.

DIGITAL I/O

The Z8536 may be programmed as 20 lines of digital I/O. Each line may be independent set for input or output and may be inverting or non inverting. Once the digital I/O lines are programmed, writes and reads are on a byte wide basis to the three addresses for ports A, B and C. The digital I/O ports may also be programmed as a two wire or three wire handshaking interface port.

COUNTER / TIMERS

Up to three down counters may be set up independently or chained together internally. Each has an input, an output, a gate and a trigger. The trigger may be used externally or internally via software load the count value from the hold register into the counter and initiate the count down. Outputs may be square wave, one shot or pulse at terminal count; all three mode are recyclable. Inputs are programmable for level or edge trigger, either high, low, rising or falling. Outputs may be inverting or non-inverting.

16 VECTOR INTERRUPT

The Z8536 may be programmed to accept 16 independent external interrupts, high, low, rising or falling edge, and output an interrupt to the PC. The output from the Z8536 may cause a PC interrupt service routine to be executed.

The power of this chip lies in the programming!

ELECTRICAL SPECIFICATIONS

Output high	2.4V min @ -250mA
Output low	0.5V max @ 3.2 mA
Input high	2.0V min, 7.3V max
Input low	-0.3V min, 08.V max
Drive	5 LSTTL loads

SCREW TERMINALS & CABLES

University & commercial laboratory applications mean frequent signal changes and experiment re-wiring. A screw terminal board mounted on your bench, or up on the wall behind the bench, provides a clean, professional approach to experiment wiring.

Screw terminals, such the PCM-TERM33 accommodates 12-22 AWG wire.

I/O Connector

The PCM-D28C3 employs a 33 pin subminiature D type connector, the connections to which are shown here. PCMCIA cards are very small and narrow so present some challenges to real world connection. The connector chosen is a standard AMP part. Mating cables and connectors are readily available.

33 Pin I/O Connector
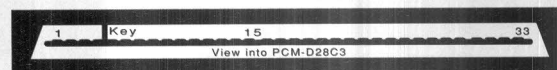
Because of the fully programmable capabilities of the Z8536, pin assignments are re-assigned as the chip is programmed to perform certain functions.

Chassis Ground & Digital Ground on Connector Housing & Shield

Pin	Signal	Pin	Signal
1	Port A0	16	Port B7/ Ctr 1 Gate
2	Port A1	17	Port C0/ Ctr 3 Out
3	Port A2	18	Port C1/ Ctr 3 In
4	Port A3	19	Port C2/ Ctr 3 Trig
5	Port A4	20	Port C3/ Ctr 3 Gate
6	Port A5	21	D Out 0
7	Port A6	22	D Out 1
8	Port A7	23	D Out 2
9	Port B0/ Ctr 2 Out	24	D Out 3
10	Port B1/ Ctr 2 In	25	D Out 4
11	Port B2/ Ctr 2 Trig	26	D Out 5
12	Port B3/ Ctr 2 Gate	27	D Out 6
13	Port B4/ Ctr 1 Out	28	D Out 7
14	Port B5/ Ctr 1 In	29	Int Out
15	Port B6/ Ctr 1 Trig	30	2.5MHz Out
		31	5MHz Out
		32	NC
		33	NC

I/O & CONTROL REGISTER MAP

The PCM-D28C3 is a PCMCIA interface card and conforms to Type II specifications. PCMCIA (Personal Computer Memory Card International) is a special system of I/O expansion originally designed to provide Laptop Computers with removable memory and programs (Type I). The specification has been expanded to Type III in order to accommodate thicker cards with more capability. Examples are the Kitty Hawk 1.8" hard disk from HP (Type III) and the PCM-D28C3 (Type II).

PCMCIA cards require Card Installation & Register Mapping (CIRM) software be installed so the CPU will know how to handle requests and transfers to and from the PCMCIA board. CIRM software is included with the PCM-D28C3

Once the CIRM software is installed, I/O programs communicate with the PCM-D28C3 through a set of I/O registers shown here.

BASE+0	PORT A
BASE+1	PORT B
BASE+2	PORT C
BASE+3	CONTROL
BASE+4	8 DIG. OUT

ORDERING GUIDE

PCM-D28C3 multifunction A/D board. 8 Ch A/D, 3 Dig. Out, 2 Dig. In	PCM-D28C3
DOS Language Driver, Basic, C, Pascal	UNIV-DRV
4" X 4" screw terminal board for 33 pin PCM with 10" cable included.	PCM-TERM33
Cables 10" cable, 33 conductor & ground, female connectors.	PCM-C33F-10I

Parallel Port Input / Output

Data Acquisition & Control Via The PC's Parallel Printer Port Interface

LAPTOP COMPATIBLE! MAY BE USED WITH ANY PC WITH A PARALLEL PORT

INTERFACES TO COMPUTER THROUGH THE PARALLEL PORT. THIS CABLE IS INCLUDED

CABLES ARE STANDARD 37 PIN WITH D CONNECTORS

POWER IS DRAWN FROM LAPTOPS THROUGH THE MOUSE PORT OR MAY BE PROVIDED EXTERNALLY

PPIO-DIO24H

SCREW TERMINAL BOARDS ARE STANDARD! THE SAME ONES SPECIFIED FOR PLUG-IN BOARDS

ANALOG I/O FROM YOUR PARALLEL PORT!

The PPIO-AI8 ushers in a new era in compatibility. Imagine porting all of your existing data acquisition applications over to a laptop computer, or setting up a student lab without having to take the computers apart. Parallel Port Input Output (PPIO) data acquisition boards allow you to do just that.

LAPTOP COMPUTERS!

The PPIO boards do not require an expansion slot, they run directly off the parallel printer interface. Power can be supplied by the laptop computer or externally.

SLOTLESS EXPANSION

PPIO boards may be used with *any* computer with a parallel port interface which is compatible with those found on ISA bus personal computers (IBM PCs). Add analog or digital I/O without removing the case or choosing interrupts and addresses.

UNIVERSAL DRIVER SOFTWARE

The Universal Driver programming language libraries available for the PPIO boards is syntactically identical to that for the CIO-DAS08 and other plug in boards. You can simply substitute the PPIO driver for the plug-in board driver and begin using all of your existing software.

SAME SCREW TERMINALS & ACCESSORIES

The connector of each PPIO board is compatible with its plug-in board brother. If you have an investment in cables, screw terminals or EXP-16 type multiplexor boards, all of these will work with your new PPIO board.

ORDERING GUIDE

Parallel Printer Input Output (PPIO) Boards

8 Analog Input, 4 DO, 3 DI, CIO-DAS08 Compatible	PPIO-AI8
6 Channel Counter/Timer (8254 chips)	PPIO-CTR06
24 High-Drive Digital I/O, CIO-DIO24H Compatible	PPIO-DIO24H

Screw Terminal Boards

4" X 4" all signals from one 37 D connector..	CIO-MINITERM
32 Channel Analog MUX with Amplification for TCs	CIO-EXP32
16 Ch. Analog Mux with Amplification, Gains to 800	CIO-EXP16
24 Position Solid State Relay Rack, Screw Terminals	SSR-RACK24
24 SPDT Electromechanical Relays, Screw Terminals	CIO-ERB24

Cables - Signal

2 foot ribbon cable, 37 conductor, female connectors.	C37FF-2
'N' foot ribbon cable, 37 conductor, female connectors.	C37FF-##
5 foot shielded cable, molded female connectors, 37 cond.	C37FFS-5
10 foot shielded cable, molded female connectors, 37 cond.	C37FFS-10

Cables - Power

PPIO Power Cable to PS2 & Laptop Mouse Connector	CMOLEX-2M
Molex to Molex 10 Foot Cable - For Power Extension	CMOLEX-10

POWER & LAPTOPS

Laptops have limited power, and do not have extra plugs to power peripherals as do desktop computers. You can use a PPIO board with a laptop by drawing 5V power from the mouse interface on the back of your laptop. We do sell a cable, CMOLEX-2M, which adapts the molex type power connector on the supplied power cable to a PS/2 or Laptop type mouse connector. You may also power your PPIO externally.

LAPTOP OR PS2 MOUSE HERE

PPIO POWER CABLE HERE

Call for Friendly Technical Assistance - (508) 261-1123
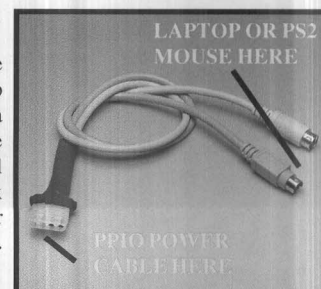
PPIO-AI8

8 Channel Analog Input, 4 Digital Output, 3 Digital Inputs

AD574 A/D CONVERTER (12 BIT)   THREE RANGES +/-5, +/-10 & 0-10V

37 PIN CONNECTOR IS 100% CIO-DAS8 COMPATIBLE

POWER CABLE SUPPLIED WITH PPIO-AI8
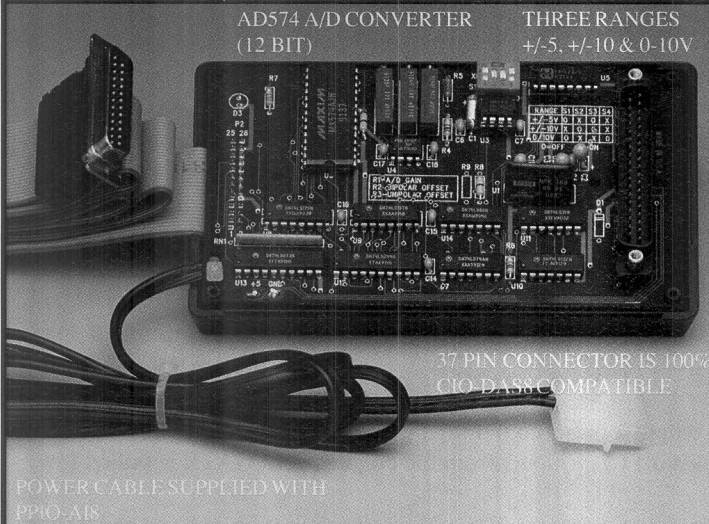
The PPIO-AI8 is functionally compatible with the CIO-DAS08 (MetraByte DAS-8). The connector pin-out is identical.

Of course, some functions of bus based plug-in boards cannot be supported by the printer interface so features that required interrupt service routines on the CIO-DAS8 are not supported. Please refer to the block diagram and specifications.

+10V	19		37	AI0
LLGND	18		36	AI1
LLGND	17		35	AI2
LLGND	16		34	AI3
LLGND	15		33	AI4
LLGND	14		32	AI5
LLGND	13		31	AI6
LLGND	12		30	AI7
GND	11		29	+5V
DO3	10		28	GND
DO2	9		27	DI2
DO1	8		26	DI1
DO0	7		25	DI0
NC	6		24	NC
NC	5		23	NC
NC	4		22	NC
NC	3		21	NC
NC	2		20	NC
NC	1			

CIO-EXP32 EXPAND TO 128 ANALOG INPUTS

The PPIO-AI8 analog inputs may be expanded to 16, 32 or all the way to 128 in blocks of 16. The CIO-EXP16 and EXP32 (see data sheets elsewhere in this catalog) supply gains up to 800, and thermocouple signal conditioning for open thermocouple detect and cold junction compensation.

A/D THROUGHPUT

The A/D converter chip and analog front end are capable of sampling in excess of the PPIO-AI8's specified 1,000 to 3,000 samples per second. The primary throughput limitation is the parallel port. Experience with a number of applications indicates the maximum A/D rate to be about 3KHz.

Another important aspect of PPIO-AI8 analog throughput is the pacing. There is no counter on the PPIO-AI8 nor is there provision for external interrupts via the parallel port. The PPIO-AI8 must rely on software pacing. Software pacing based on the PC Clock is reliable up to about 500Hz.

ANALOG INPUT - LPT: INTERFACE

The PPIO-AI8 is a full function analog input accessory for your computer. It comes complete with cables for computer and power, a complete applications manual and software for calibration and test. It may be programmed from most languages with the Universal Driver and is supported by Labtech Notebook and Control-CB.

SIMPLE TO INSTALL

Simple to install and use, the PPIO-AI8 connects directly to any one of your computer's parallel printer ports. No need to remove the computer's cover or deal with address or interrupt conflicts. Just set the PPIO-AI8 to the range you desire and connect it to your computer's printer port with the cable supplied.

USE LPT1:, LPT2:, LPT3: or LPT4:

The PPIO-AI8 will operate from any of the PC's parallel printer ports. and may be powered by the PC, or externally. The PPIO-AI8 will not work on the same port a printer is attached to. One or the other must be used at one time.

CONNECTOR COMPATIBLE WITH CIO-DAS08

BLOCK DIAGRAM
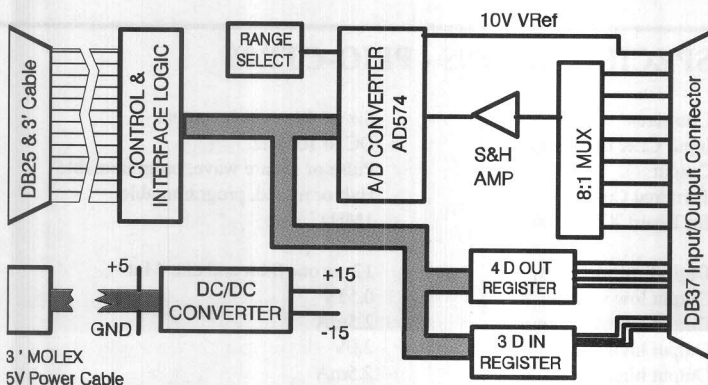
SPECIFICATIONS - PPIO-AI8

Analog Input Channels	8 Single Ended Inputs
Resolution	12 Bit, 1 part in 4096
Ranges	+/-5V, +/-10V, 0-10V, Switch Selectable
A/D Type	Successive Approx. AD574
Accuracy	0.01% +/- 1 LSB
Throughput	1-3KHz, Computer & Program Dependent
Integral Linearity	+/- 1 LSB
Input Leakage Current	200nA Max, 0.3nA Typical
Gain Drift	+/-25 ppm/Deg C Max
Zero Drift	+/- 10 ppm/Deg C Max
Digital Inputs	3, LSTTL
Digital Outputs	4, LSTTL
Power Consumption	5V @ 300mA

PPIO-CTR06

Six, 16 Bit Down Counter Timers - Two 82C54

Six 16 Bit Counters

POWER & PC INTERFACE CABLE INCLUDED
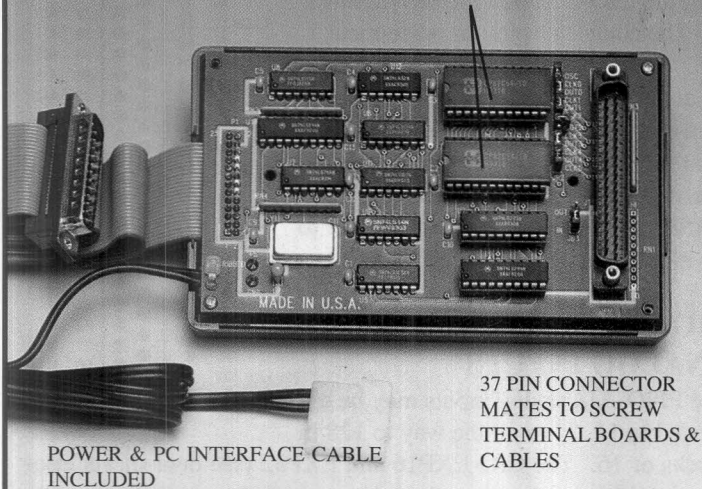
37 PIN CONNECTOR MATES TO SCREW TERMINAL BOARDS & CABLES

PROGRAMMING

Programming the PPIO-CTR06 is easy. Use the Universal Driver (purchase separately) to control the PPIO-CTR06 from C, Pascal, or Basic. For assembly language programmers or those who want to write their own routines in C, examples on disk shipped with the PPIO may be all you need.

CLK ⊓⊓⊓⊓⊓⊓⊓⊓⊓⊓⊓⊓⊓⊓⊓

Gate

OUT
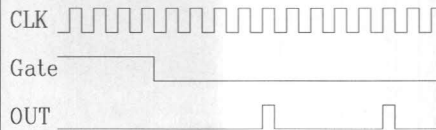
Here is an example using a counters ability to divide a source signal. The counter is programmed to divide the source signal by 5 and to output a pulse on terminal count. The hardware signal, GATE, holds off CLK inputs from the counter until GATE is pulled low.

The digital ports are TTL. They may be set up as 8 out and 4 in or 4 out and 8 in.

COUNTERS & DIO - LPT: INTERFACE

The PPIO-CTR06 provides counters and digital I/O, interfaced to your PC's parallel port. It comes complete with cables for parallel interface and power, a complete applications manual and software. Simple to install and use, the PPIO-CTR06 connects directly to any one of your computer's parallel printer ports. No need to remove the computer's cover or deal with address or interrupt conflicts.

FEATURES

The PPIO-CTR06 has:

Two 82C54 Counter Chips, each of which has
Three 16 bit Counters, consisting of
CLK Input (10MHz max)
GATE to control input
OUT to provide pulses or square waves.
4 Digital Inputs
4 Digital Outputs
4 Digital which may be set to Input or Output

SIGNAL CONNECTOR

The PPIO-CTR06 signal connector is a 37 pin D type connector, like those used on most other ComputerBoards data acquisition and control boards. All 6 counter CLK, GATE and OUT signal lines as well as 12 digital.
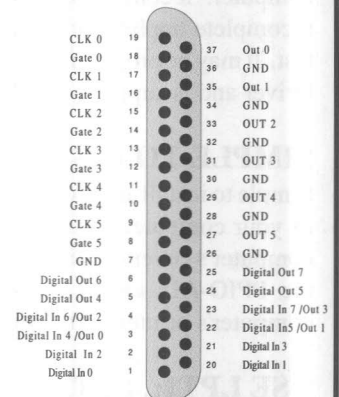
Screw terminals and connectors such as CIO-MINI37 and DFCON-37 will interface to the PPIO-CTR06

CLK 0	19	
Gate 0	18	37 Out 0
CLK 1	17	36 GND
Gate 1	16	35 Out 1
CLK 2	15	34 GND
Gate 2	14	33 OUT 2
CLK 3	13	32 GND
Gate 3	12	31 OUT 3
CLK 4	11	30 GND
Gate 4	10	29 OUT 4
CLK 5	9	28 GND
Gate 5	8	27 OUT 5
GND	7	26 GND
Digital Out 6	6	25 Digital Out 7
Digital Out 4	5	24 Digital Out 5
Digital In 6 /Out 2	4	23 Digital In 7 /Out 3
Digital In 4 /Out 0	3	22 Digital In5 /Out 1
Digital In 2	2	21 Digital In 3
Digital In 0	1	20 Digital In 1

COUNTER CHAINING JUMPER

The counters may be chained together to form 32 bit, 48 bit or up to one 96 bit counter. A set of jumpers on the PPIO-CTR06 provide quick chaining of the 1MHz XTAL into CLK0, OUT0 into CLK1, OUT1 into CLK2 and so on. Other chaining schemes may be devised and wired up at the connector.

BLOCK DIAGRAM

SPECIFICATIONS - PPIO-CTR06

Counters
Counters	Six 16 Bit down counters
Input CLK frequency	DC to 10MHz
Output	Pulse or square wave, programmable
Terminal Count	Halt or reload, programmable
On Board XTAL Osc.	1MHz

Digital Inputs/Outputs
Digital Inputs/Outputs	12 as one 8 bit and one 4 bit
Output low voltage	0.55V
Output low sink current	2.5mA
Output high voltage	2.0V
Output high source current	2.5mA
Power Consumption	+5V @ 400mA
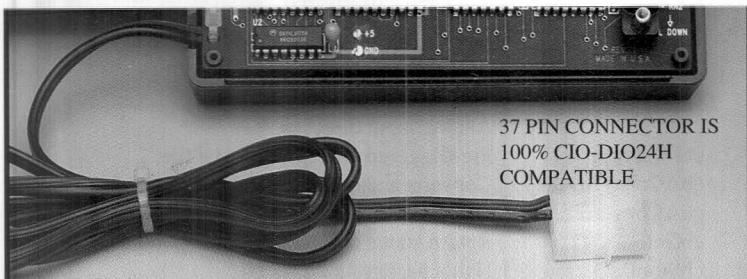
DIGITAL I/O - LPT: INTERFACE

The PPIO-DIO24H is a complete digital sense & control accessory for your personal computer. It comes complete with cables for parallel interface and power, a complete applications manual and software for calibration and test.

SIMPLE TO INSTALL

Simple to install and use, the PPIO-DIO24H connects directly to any one of your computer's parallel printer ports. No need to remove the computer's cover or deal with address or interrupt conflicts.

USE LPT1:, LPT2:, LPT3: or LPT4:

The PPIO-DIO24H will operate from any of the PC's parallel printer ports and may be powered by the PC, or externally. Each PPIO board requires one dedicated LPT port, which may not be simultaneously used by a printer.

CONNECTOR COMPATIBLE WITH CIO-DIO24H

BLOCK DIAGRAM
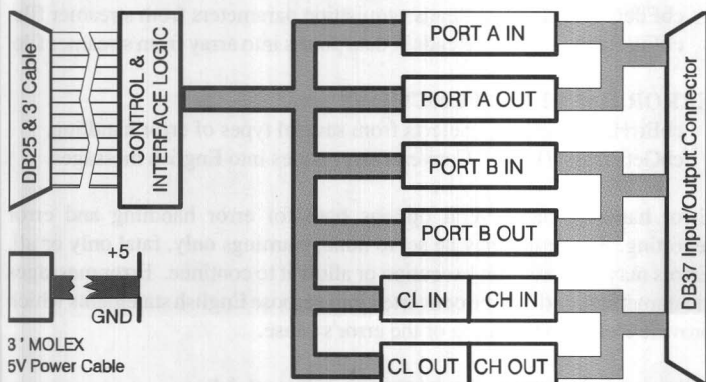
SENSE AC & DC POWER

Connect a CIO-ERB24 electromechanical relay rack or an SSR-RACK24 with 24 solid state relays and you can sense or control AC and DC voltages directly from your laptop or desktop personal computer.

Because the PPIO-DIO24H has high drive digital inputs & outputs, it has the power to directly control relays, LEDs and other devices requiring up to 60mA of current.

GND	13		31	A6
NC	12		30	A7
GND	11		29	C0
B0	10		28	C1
B1	9		27	C2
B2	8		26	C3
B3	7		25	C4
B4	6		24	C5
B5	5		23	C6
B6	4		22	C7
B7	3		21	GND
NC	2		20	+5V
NC	1			

PROGRAMMING

Programming the PPIO-DIO24H is easy. Use the Universal Driver (purchase separately) to control the PPIO-DIO24H from C, Pascal, or Basic. For assembly language programmers or those who want to write their own routines in C, examples on disk shipped with the PPIO may be all you need.

The PPIO-DIO24H is supported by Labtech Notebook and Control CB. It is supplied with software for testing and troubleshooting.
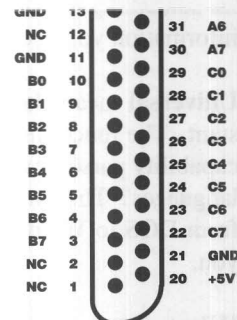
POWER & LAPTOPS

Laptops have limited power, and do not have extra plugs to power peripherals as do desktop computers. You can use a PPIO board with a laptop by drawing 5V power from the mouse interface on the back of your laptop. We do sell a cable, CMOLEX-2M, which adapts the molex type power connector on the supplied power cable to a PS/2 or Laptop type mouse connector. You may also power your PPIO externally.
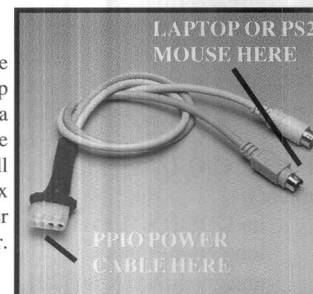
SPECIFICATIONS - PPIO-DIO24H

Digital Inputs/Outputs	24 as two 8 and two 4 bit ports
Output low voltage	0.55V
Output low sink current	64mA
Output high voltage	2.0V
Output high source current	15mA
Power Consumption	+5V @ 400mA

Universal Driver
I/O Board Programming Tools for All Boards & All Languages

UNIVERSAL

After years of supporting a different set of drivers for each board and language, ComputerBoards is proud to introduce the Universal Driver, a complete set of I/O tools for all our boards for all languages.

Universal means **board** to board the **syntax** for an analog input is the same. From CIO-DAS08 to CIO-DAS16/M1 the programming line looks the same. In addition, the Universal Driver is intelligent. It knows about individual boards and their capabilities. If you ask for something the board cannot do, a warning message supplies the information you need to correct the program.

Universal means **language** to language the **syntax** remains constant. The functions and features remain constant. The intelligent capability parser remains constant. Want to change programming languages? The Universal Driver requires no re-learning. Moving from DOS to Windows? The Universal Driver code moves with you.

What about advanced features?

I/O boards do differ in features. The resolution, maximum speed, transfer methods, channel strategy and gain coding are all features which change from board to board affecting price and performance.

Lets take a look at 3 boards which use the function cbAIn Scan(). In each example we will use the maximum A/D rate for the board.

'C' Example

FEATURE	CIO-DAS08	CIO-DAS16/Jr	CIO-DAS16/330i
Speed	20KHz	110KHz	330KHz
Trxfr Method	Interrupt	D.M.A.	RepInSW
Gain	Switch	Programmable	Ch/Gain Queue

For the CIO-DAS08:
```
main()
    int UDStat = 0, LowChan = 0, HighChan = 1, Gain = BIP5VOLTS
    long NumPoints = 20, Rate = 20000
    unsigned DataArray[20], Options = 0
    UDStat = cbAInScan (BoardNum,LowChan,HighChan,NumPoints,
                    &Rate, Gain, DataArray, Options);
```
/*Variables are positional so the variable, *Gain*, must be in the list although it is ignored in this case because the CIO-DAS08 gain is switch-set, not programmable.*/

For the CIO-DAS16/Jr:
```
main()
    int UDStat = 0, LowChan = 0, HighChan = 1, Gain = BIP5VOLTS
    long NumPoints = 20, Rate = 110000
    unsigned DataArray[20], Options = 0
    UDStat = cbAInScan (BoardNum,LowChan,HighChan,NumPoints,
                    &Rate, Gain, DataArray, Options);
```

For the CIO-DAS16/330i
```
main()
    int Chan[BIP2PT5VOLTS], Gain[BIP5VOLTS], Count = 2
    Chan[0] = 0; Chain[1] = 1
```

FUNCTIONS

The Universal Driver is built upon individual functions, each of which programs, triggers, reads from or writes to a boards I/O components.

I/O board functions may be grouped into:

ANALOG I/O

cbAin()	Single analog input.
cbAinScan()	Input from ChLo to ChHi N time at R rate.
cbALoadQueue()	Load channel/gain queue.
cbAOut()	Single analog output.
cbAoutScan()	Output from ChLo to ChHi N times at R rate.
cbAPreTrig()	Set pretrigger buffer and scan values.
cbATrig()	Analog trigger setup.
cbAFileAinScan()	Analog input direct to file.
cbFilePreTrig()	Pre-triggered analog input to a file.
cbAConvertData()	Converts analog input to channel/data format.
cbAConvertPretrigData()	Unload & convert pretrigger data.
cbGetStatus()	Return status of a background operation.
cbStopBackground()	Halt a background process.

THERMOCOUPLE INPUT

cbTIn()	Inputs, Smooths, compensates & linearizes TC
cbTInScan()	Same for a range of Thermocouples.

COUNTER

cbC8254Config()	Select counter operating mode for 82C54 chips.
cbC9513Config()	Programmable option set for 9513 chips.
cbC9513Init()	select board specific features for 9513 chips.
cbCFreqIn()	Measure frequency using counters.
cbCIn()	Read counter.
cbCLoad()	Load counter value.
cbCStoreOnInt()	Store counter value on interrupt.

DIGITAL I/O

cbDBitIn()	Input a single digital bit..
cbDBitOut()	Output a single digital bit.
cbDConfigPort()	Configure one port for input or output.
cbDIn()	Input a single 8 bit port.
cbDInScan()	Reads N bytes at R rate from one port.
cbDOut()	Output a single 8 bit port.
cbDOutScan()	Outputs N bytes at R rate to one port.

STREAMER FILE FUNCTIONS

cbFileAinScan()	Transfer analog input directly to streamer file.
cbFilePreTrig()	Use pretrigger strategy to streamer file.
cbFileGetInfo()	Reads acquisition parameters from streamer file.
cbFileRead()	Reads N data points into array from streamer file.

ERROR HANDLING FUNCTIONS

cbErrHandling()	Selects from several types of error handling.
cbGetErrMsg()	Converts error codes into English messages.

Error handling has several options both for error handling and error reporting. Reporting may be set to none, warnings only, fatal only or all. Errors may halt program execution or allow it to continue. Error messages are numerical, and may be converted into verbose English statements which provide a clear explanation of the error's cause.

Universal Driver programs are easy to write and debug.

PROGRAMMING EXAMPLES (Cont.)

```
        int UDStat = 0, LowChan = 0, HighChan = 1, Gain = 2
        long NumPoints = 20, Rate = 110000
        unsigned DataArray[20], Options = 0
        UDStat = cbAInScan (BoardNum, LowChan, HighChan, NumPoints,
                        &Rate, Gain, DataArray, Options);
        /*Variables are positional so HighChan, LowChan and Gain must be
specified even though not used.  The channel gain queue is automatically
used after cbALoadQueue has been called to load it.*/
```

Notice that the transfer method is not specified although three different methods (1 per example) were employed. The Universal Driver is intelligent and applies board specific strategies which best match the requirements of the acquisition. You may allow the Universal Driver to select the transfer method or you may specify it in the Options field.

Note that the variables are positional and the names are used for clarification only. The CIO-DAS08 example could have been:
UDStat = cbAInScan (0, 0, 1, 2000, &Rate, 0, DataArray, Options);

Quick Basic Example

Before looking at the Quick Basic code, lets cover a few points skipped in the 'C' example above. First, there are header files for each language which contain descriptions of boards and other system variables. Part of the header file reads a configuration file which identifies boards, switch and jumper settings and accessories attached. The configuration file is created by a menu driven program (described to the right).

```
'$INCLUDE: 'CB.BI'                              'Mandatory include file
CONST BoardNum = 0, NumPoints = 50             'Use board 0 from config
'$STATIC
        DIM DataBuffer%(NumPoints)
LowChan% = 0                                    'First channel
HighChan% = 1                                   'Last channel
Count& = NumPoints                             'Number of points to collect
Rate& = 10                                     'Rate = 10 samples/sec
Gain% = BIP5VOLTS                              'DAS08 not prog. gain
Options% = CONVERTDATA                         'Return 12 bit values
UDStat = cbAInScan% (BoardNum, LowChan%, HighChan%, Count%,
        Rate&, Gain%, DataBuffer%(0), Options%)
```

Note that cbAInScan and variable values are alike for this QuickBasic example and the 'C' example. Differences in the example are limited to non-Universal Driver statements.

Once you learn Universal Driver for one language, your knowledge is easily transferred to other languages, *and*, you can communicate effectively with people who program in languages other than your favorite.

Oh, by the way, you do not have to change a line of code to change from one board to the next. Simply run *InstaCal*™ to assign a new board to the board number your program references. *InstaCal*™ modifies the configuration file which is read by the standard header file. The Universal Driver will apply only those features to the board which match the capabilities of the board.

InstaCal™

*Inst*allation, *Cal*ibration, Test and Measurement

InstaCal™ is a complete installation, calibration, test and measurement program for all ComputerBoards PC bus, PCM and PPIO data acquisition and control boards. Complete with extensive error checking, *InstaCal*™ guides you through installation and setup of your data acquisition board and creates the board configuration file for the Universal Driver.

First, choose a board from the list then choose from the list of installation options. As you select a base address, and other switch and jumper settings, the switch or jumper is displayed on the screen. As you select from available options, the switch or jumper moves to show the new setting.
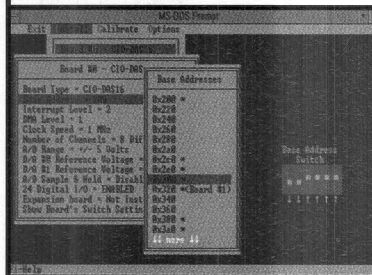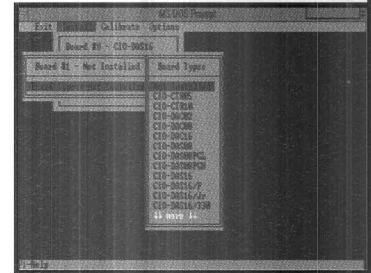
Extensive error checking prevents common installation problems like conflicting addresses and interrupts. As errors or possible conflicts are detected, warning messages are displayed. You may choose to ignore some warnings may be ignored but those which would create impossible conflicts are trapped, and prevented. Here is an example of a possible base address conflict.

In addition to displays of individual switches and jumpers, *InstaCal*™ displays a configuration diagram of the entire board showing each switch and jumper is displayed; with an arrow pointing to any item changed in the current session!
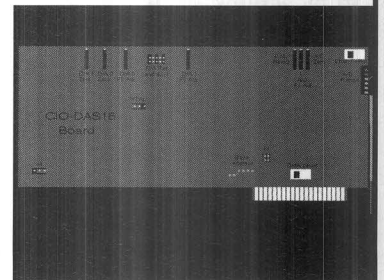
In addition to installation, a calibration program and test programs are included. The calibration program is graphical, providing step by step instruction on inputs, outputs and potentiometer trimming. Some boards may be calibrated from within *InstaCal*™, others are provided with separate calibration and test programs.
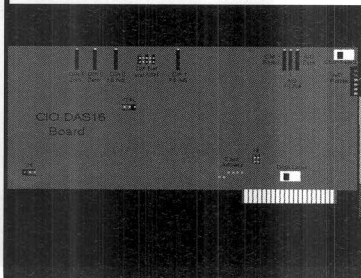
VisSim/Dacq

Windows Data Acquisition and Control With Graphical Programming & Simulation
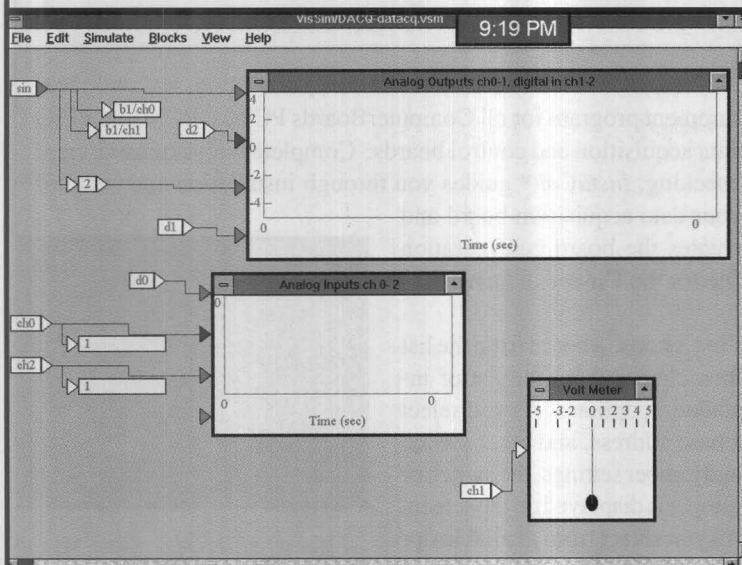
VisSim/Dacq

VisSim/Dacq is an integrated, visually programmed, data acquisition and instrument control environment with a complete systems design and simulation capability. VisSim/Dacq combines VisSim/RT, a real time interface to A/D and D/A boards, with a micro version of the popular system design and simulation software package VisSim. VisSim/Dacq makes data acquisition and instrument control fast and easy on PC's with Windows!

Easy to Learn & Use

VisSim is a visual programming environment. Visual programming is accomplished by selecting from actions, which are represented by visually descriptive blocks, and connecting the blocks together with wires. Wires indicate the order actions are to take place. The hypertext Windows Help file with complete information on blocks, visual instruments and displays provides instant access to guide your model building.
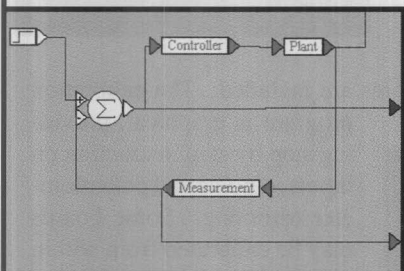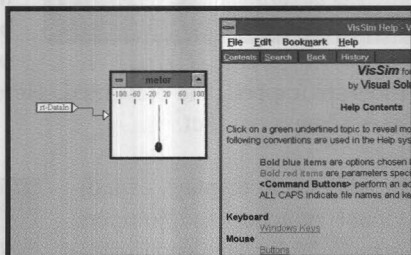
Block Programming

In VisSim, you build models in the form of block diagrams. Blocks and flex wires are your primary design tools. You wire blocks together, assign block and simulation parameters, simulate the diagram and plot results, all within a single, interactive environment. VisSim executes your block diagram and computes model outputs with no intervening steps. VisSim encourages a modular approach to large model construction by allowing the concurrent design and testing of functionally-independent subcomponents.

FEATURES & SPECIFICATIONS

Virtual Instruments: meters, digital displays, error lights & plots.
Dialog Box for selecting board and settings.
Configuration Box for setting channels, range and other settings.
DDE support for transfer between other applications, like Visual Basic.
DLL interface that lets you add your own Fortran, C or Pascal routines.
Import/Export of ASCII data with other applications or to file.
Integrated simulation, analysis and modeling capabilities.
75+ block types of both linear and nonlinear: transfer function, reset integral, limited integral, deadband, limit, delay and sample hold.
Toolboxes for analog/digital filters, signal generation and control design.
Presentation graphics: color bit-map icons, elegant printed output
Powerful interactive plotting: log-log, XY, scatter, auto scale, color coding, over plot, FFT power spectrum and more.
Max scan rate of about 500 to 1000 scans per second depending on the number of blocks and the complexity of the acquire-analyze-control-display strategy.
Max blocks: 100
System requirements: PC compatible 386, Windows 3.1 or later, 2MB RAM, 2MB free disk space, 1.2MB 5" or 1.44MB 3" floppy, EGA, VGA or higher resolution display
Drivers included for:

ComputerBoards & MetraByte

DAS16	DAS08	DDA06	DIO24
DAS16/Jr	DAS08-PGH	DAC02	DIO48
DAS1600	DAS08-PGL	DAC08	DIO96
	DAS08-AO	DAC16	

Data Translation	Advantech	
DTI-2811PGH	PCL711(S)	PCL812(PG)
DTI-2811PGL	PCL718	PCL818

Converting Equations to Block Diagrams

Systems of equations may be categorized as:

Linear or non-linear.	Static or dynamic.
Continuous or discrete.	Time varying or time invariant.
Lumped or non-lumped parameters.	

VisSim is capable of solving all but equations whose parameters are non-lumped or containing partial differentiation. Converting the more fundamental system equations, such as linear and nonlinear static equations to block for is a fairly intuitive process in VisSim.

This method of visual programming by connecting blocks with wires is more intuitive and faster than coding in a standard language!

CHECK OUR LOW PRICES - See Table of Contents
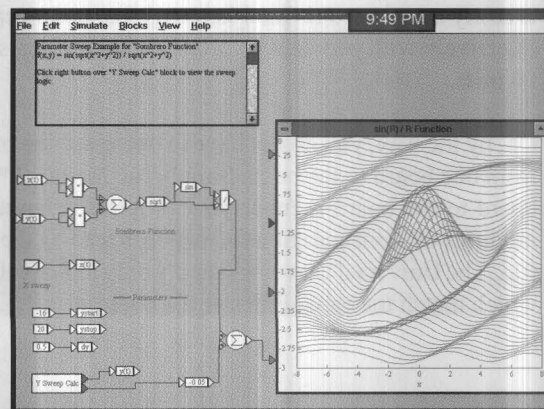
Control-CB

Low Speed Data Acquisition and Control with Data Logging and Display.

Control-CB

ComputerBoards purchased the license for Control EG from Quinn-Curtis Software and has re-introduced it as Control-CB at a 1/5th the price with more features!

Control-CB is a full function data acquisition and control package with pop-up menus and full CGA, Hercules or EGA graphics.

When used with the CIO-EXP thermocouple measurement accessory, Control EG is a powerful temperature measurement, logging and alarming system. Add digital output and heaters, blowers, ovens and burn-in chambers may be precisely controlled.
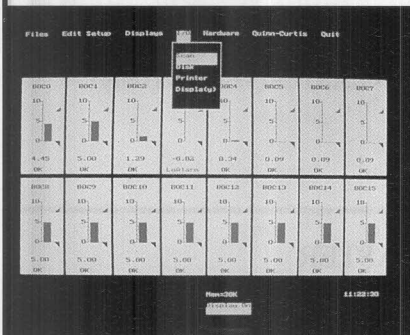
A bargraph display of analog or digital values in a process control faceplate format is just one of the displays in Control EG. Alarm status and the real time value are updated constantly.

Control-CB is easy to learn and easy to use. Its context sensitive help and ability to store configurations in setup files add reliability also. The context sensitive help file with complete information on a pull down menu's options is available from the F1 key at any time.

Lets explore Control-CB's ease of use. First, simply choose the analog input, analog output and digital I/O board(s) from the install menu. Add any expansion or signal conditioning boards, then go to set-up.

Install I/O Boards

Now choose the channels to monitor, what type of measurements to make, when to set off alarms, how you want controls applied, and which outputs will actuate the controls. It is all menu selected and may be saved in a file and automatically started whenever you start Control-CB.

Set-up Inputs & Outputs

Choose a display type and the values to be displayed. Up to 6 different real-time display types may be viewed while data is being collected. A trend graph is shown here while bar graphs are shown to the left.

Choose Displays and Values

Control professionals and first time users have enjoyed the ease of use and reliability of Control-CB for over 8 years.

You and your customers will appreciate how Control-CB simplifies the application of a personal computer and data acquisition and control boards.

Professional Control

HOW CAN IT BE SO INEXPENSIVE?

ComputerBoards introduced the concept of low cost hardware and standard architectures in 1989. We brought the price of hardware down but software remained far too expensive.

ComputerBoards purchased the rights to Control-EG, which sold well at $495. We enhanced it, added support for all our CIO, PPIO and PCM boards and cut the price to $(Quick! See the price list).

The real question is not, 'How can it be so inexpensive', but, 'How can you afford to write a program when you can buy Control-CB'?

SPECIFICATIONS

SCAN RATE
10 Hz Scan Rate
Each scan reads all channels and executes all control algorithms and outputs.
MAX CHANNELS
Up to 128 Analog input and 32 out.
Up to 128 Digital inputs and 128 outputs.
A total of 256 active points at one time.
MEASUREMENT TYPES
Measure Voltage, Temperature, Pressure.
Linearize J,K,S,T,E,R, & S thermocouples
User defined calculated inputs.
CONTROLS
Real Time Scheduler
Up to 64 PID loops.
Up to 64 calculated channels
Sequencer and digital logic functions

ALARMS
High and Low Alarms
Alarm Filter
DISPLAYS
Change displays "on the fly".
Change Alarms "on the fly".
16 Channel Bargraph display.
64 Channel annunciator display.
16 Channel stripchart/history display.
16 Channel XY plot display.
16 Channel text display.
8 Levels of group displays
DATA LOGGING
Data Logging to Disk & Printer
FILE EXPORT
Export to Lotus 123 file
On line, context sensitive HELP

Order   Control-CB

Software Packages for ComputerBoards I/O
20% off Manufacturers List Price (USA Only)
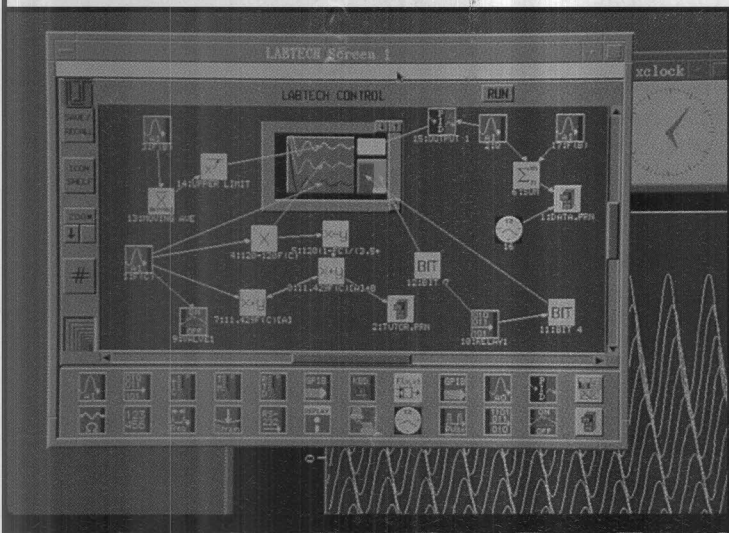
Labtech Notebook & Notebook/LE

The ever popular Labtech Notebook now ships with both the DOS and Windows version in one package; and include Icon-View (shown to the left).

Notebook/LE is a lighter version of Notebook, designed for systems with fewer than 25 I/O and calculation blocks. It too is supplied with DOS and Windows versions in one box.

Labtech is the most popular data acquisition and control package ever made. Easy to use and flexible, it is a standard.

Supports: DAS08, DAS16, DIO & CTR families of boards.
SNAP-SHOT (DOS only) SNAP-MASTER(Windows only)
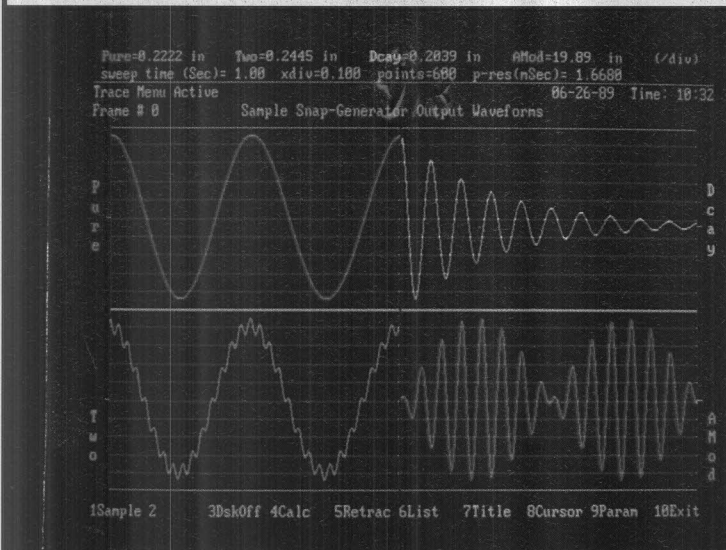
SNAP-SHOT & SNAP-MASTER

HEM Data brings you two versions of its oscillographic recording, display and analysis package; SNAP-SHOT for DOS and SNAP-MASTER for Windows.

Both products provide a complete data acquisition, display and analysis system. The easy to use user interface employs function keys (DOS) or the mouse to point and click from available options.

Data acquisition routines support the full feature set of the board and provide flexible triggering and pre-post trigger buffers.

The display may be configured for to show original wave forms and the results of intermediary calculations.

Supports: DAS08, DAS16, DIO & CTR families of boards.
SNAP-SHOT (DOS only) SNAP-MASTER(Windows only)

C-TOOLS & T-TOOLS

These popular libraries, formerly from Quinn-Curtis, are now supplied directly from ComputerBoards.

C-TOOLS is for use with Microsoft or Borland C and is written in C. The source code to the libraries is included allowing you to customize or extend the data acquisition and control functions.
Supports: DAS08, DAS16, DIO & CTR families of boards.
DOS only

T-TOOLS is for use with Turbo Pascal. Included are routines for data acquisition and control, thermocouple linearization, graphics and scientific functions. Includes Turbo Lablog application program source code written in Turbo Pascal.
Supports: DAS08, DAS16, DIO& CTR families of boards.
DOS only

CHECK OUR LOW PRICES - See Table Of Contents

Supports: You will need I/O board drivers, like C or T tools.
DOS only
Order Part # IPC-xx-025 (xx indicates language)

Supports: You will need I/O board drivers, like C or T tools.
DOS only
Order Part # IPC-xx-0x6 (xx indicates language)

Windows Charting Tools from Quinn-Curtis

Windows Charting Tools let you create and incorporate sophisticated business and scientific charts in your own Windows applications. A comprehensive library of functions supports chart types including line plots, area plots, horizon bars, scatter plots, group plots, high-low close plots and pie charts.

Once the charts have been created they can be printed to the Windows print manager, and any device it supports.

There are no royalties or fees associated with the use of Windows Charting Tools when they are used to create Windows application programs.

Does not include data acquisition board drivers.
Windows only.
See part numbers WIN- below

Driver LINX for Windows

Driver LINX for Windows contains over 70 routines for creating foreground and background tasks providing analog input and output, digital input and output and frequency, pulse and event counting. A complete application and learning environment as well as board drivers are included. VB Part # support Visual Basic.
Supports DAS8 or DAS16. See part #.
Windows only.
See part numbers DLINX-##

VSTAT!

VSTAT! Virtual Timer Library provides the highest level of programming support available for the 9513 counter timer. *VSTAT!* provides high-resolution virtual timers based on the 9513 which may be used for:Execution Profiling, Performance Testing, Interval Measurement, Precision Delays.
VSTAT! features microsecond resolution, auto calibration, pass statistics, event logging and report generation. It is written in C and the source code is included.

Supports CIO-CTR05 & CTR10, and all 9513 based counter boards.
DOS Only

THIRD PARTY SOFTWARE PRICES

Part No	Mfg List	CBI List
DLINX-16		
DLINX-16VB		
DLINX-8		
DLINX-8VB		
Realt Time Graphics & Measurement		
IPC-TP-025, for Turbo Pascal 5.x, 6.x		
IPC-TC-025. for Turbo C 2.x, C++		
IPC-MC-025, for Microsoft C 5.x, 6.x, QC		
Science & Engineering Tools		
IPC-TP-016, for Turbo Pascal 5.x		
IPC-TC-006, for Turbo C 2.0, C++		
IPC-MC-006, for MS C 5.1, 60., QC		
IPC-QB-006, for MS QuickBasic 4.0, 4.5		
IPC-MF-006, for MS Fortran 5.0		
Labtech Notebook		
Labtech Notebook/LE		
Labtech Control Level I		
Labtech Control Level II		
Labtech Control Level III		
SNAP-SHOT		
SNAP-MASTER		
VSTAT!		
Windows Charting Tools		
WIN-BMC-100, for C		
WIN-BMC-101, for C with DLL source		
WIN-BMC-102, for C with C source		
WIN-BP-100, for Pascal		
WIN-BP-102, for Pascal with source		
WIN-VB-100, for Visual Basic		
WIN-VB-102, for Visual Basic with source		

SOFTWARE CATALOG
Volume 6
Get the most complete catalog of data acquisition and control software and reference books. Get the ComputerBoards Data Acquisition Software catalog, volume 6.

Watch the mail for your copy soon!

50 UNIT O.E.M. CUSTOM DESIGN SERVICE

As an OEM (systems builder) you know the value of every component in your system. Interface boards with not enough of the functions you require and a few that you do not add up to extra expenses you do not need. Expenses like wasted chassis slots, and an MTBF complicated by components you don't even use. Computer Boards, Inc. will design, build, and stock a board that does exactly what you want. A board that will save you money. You save because the board is priced low. You save when all the functions fit on the minimum number of boards. You save on maintenance, stocking fewer boards. You save on reliability and repair when only the components you need are on the board. You save on design costs. You take advantage of Computer Boards' components purchasing power and you have a reliable partner in the board business who stocks your OEM design for immediate delivery.

Look at the examples below. Each of these OEMs had special problems and needs. They were meeting those needs with standard products but knew an optimal design would improve their systems.
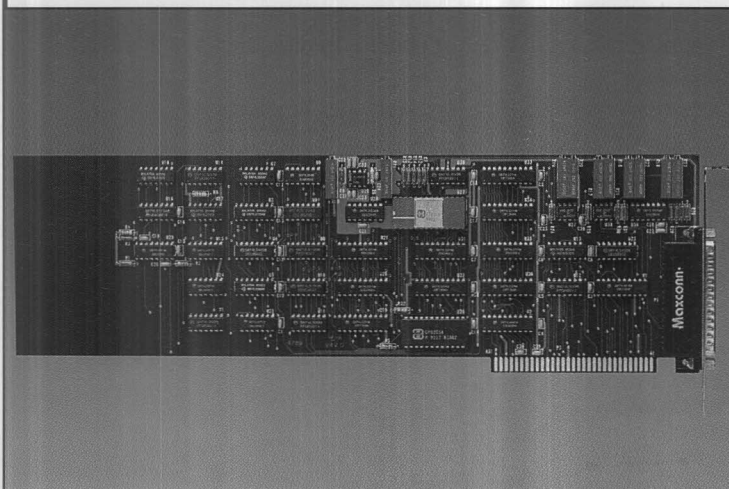
N.R.E $0, Board $649, Savings over $40,000

TWO STANDARD PRODUCTS, ONE BOARD

A provider of Thermographic Recorders for diagnosis of pain and inflammation built a system based on the DAS-16/F and DAC-02. The system sold well and demand grew. Customers asked for a smaller system and the OEM responded with a 386 PC clone in a small, custom enclosure. The O.E.M. knew there was fat in the price of the I/O boards, two connectors and cables where one would do and a wasted slot as well. We put all the functions onto one board with one connector for a final board price of $649. Competitor's equivalent price? $1,464. Savings? Over $40,000 per year in I/O board cost alone. And the system today is more desirable to the customer.
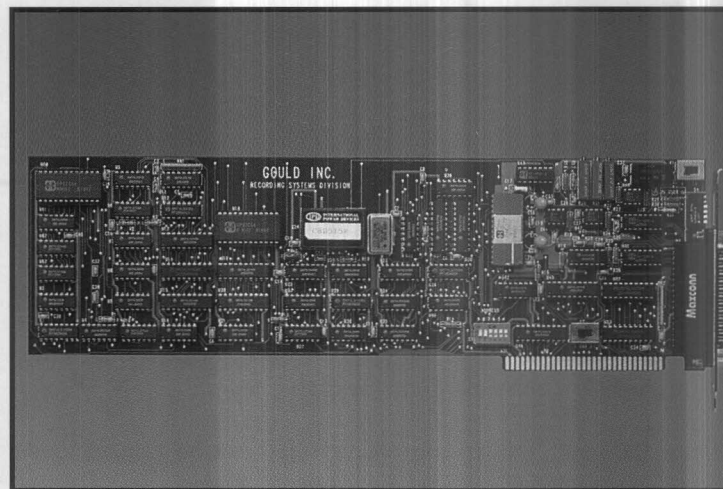
N.R.E $0, Board $599, Savings over $60,000

STANDARD/CUSTOM MIX

Taking advantage of new technology is exciting! An old-line supplier of Oscillographic recorders introduced a personal computer based upgrade to it's installed base. Potential market? Who knows but the installed base was over 5,000! Customer acceptance was good and sales grew accordingly. The interface portion of the system employed a DAS-16/F and a custom board which supplied the extra timing signals required for burst-mode signal acquisition. Combining the two boards and eliminating the un-used analog outputs would save money and increase reliability. Competition + custom board cost? $1,200. Computer Boards solution? $599. Savings? Over $60,000 per year.
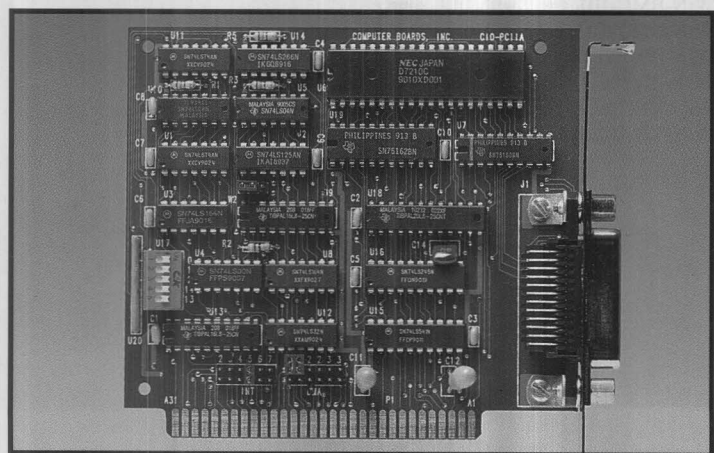
N.R.E $0, Board $85 Savings over $150,000

STANDARD PRODUCT - BIG SAVINGS

The CIO-PC2A to the left is an identical clone of the industry standard PCIIA. Our customer was paying a high price for hundreds of boards per year. They asked us how aggressive our pricing could get. We showed them; 85$ each in quantities of 25. Savings? Over $150,000 per year!

WHAT ABOUT YOU?

Do you buy any board in quantities of 25 or more per year? Are you convinced you are getting the lowest possible price? Is it exactly what you want? Does it give you the kind of performance you imagined it would? These are only three examples from the many special projects completed for customers in the U.S.A and abroad. Shouldn't you call for a **free** quote today? (508) 261-1123.
Outside U.S.A. please call your distributor.

Quality & Service

Lifetime Product Warranty

Every Computer Boards, Inc. product is warranted against defects in materials or workmanship for the life of the product. Any products found to be defective in material or workmanship will be repaired or replaced promptly.

Lifetime *Harsh Environment Warranty*™

Any Computer Boards, Inc. product which is damaged due to misuse may be replaced for only 40% of the current list price. I/O boards face some harsh environments, some harsher than the boards are designed to withstand. When that happens, just return the board with an order for its replacement at only 40% of the list price. Computer Boards does not need to profit from your misfortune. By the way, we will honor this warranty for any other manufacture's board that we have a replacement for!

The replacement discount from list price is based on the U.S.A. list prices in this catalog and is valid only for products purchased before the next catalog volume number is issued. If prices go down or costs go up in future catalogs, the replacement discount may be adjusted to reflect current conditions, but, you have our pledge that it will always be as fair as possible. **The Harsh Environment Warranty is honored world-wide, at fixed U.S.A. prices.**

30 Day Money-Back Guaranty

Any Computer Boards, Inc. product may be returned within 30 days of purchase for a full refund of the price paid for the product being returned. If you are not satisfied, or chose the wrong product by mistake, you do not have to keep it. Please call for an RMA number first. Software is subject to a re-packaging fee.

Orders Shipped Same Day

Any Computer Boards, Inc. product ordered before 2:00 P.M. Eastern time will be shipped that day unless a different ship date is given at the time of order. There is no extra charge for this service and, should we ever miss a promised ship date, Computer Boards will pay the freight.

Warranty & Repair in One Day

Any Computer Boards, Inc. product returned for repair under warranty will be repaired and shipped within 24 hours unless a Technical Support Engineer must contact and discuss the repair with you. Repairs are returned shipped by the same method as they are received. Please call for an RMA first.

Free Technical Assistance

Computer Boards, Inc. was founded by ex-MetraByte data acquisition professionals who built a technical support group which was regarded the best in the industry. The tradition was carried with the founders to Computer Boards where our dedication to competent, responsive technical support both before and after the sale is being applied through high quality staffing and support tools such as expert systems and state of the art test equipment.

ORDERING & TERMS

HOW TO ORDER

Orders are accepted by telephone, (508) 261-1123, FAX, (508) 261-1094 or written purchase order to 125 High Street #6, Mansfield, MA, 02048. Business hours are from 8:00 A.M. to 5:00 P.M. Eastern Time.

TERMS

Purchases may be made by company purchase order, VISA, MasterCard, American Express, pre-payment or C.O.D. To establish credit terms please provide banking information and two trade references and allow a minimum of three days for credit approval. Credit terms are net 30 days. Same day shipment policy applies only to approved credit customers, C.O.D. and credit card purchases.

SHIPMENT

Orders are shipped F.O.B. Mansfield, MA via UPS ground, insured, unless otherwise specified at the time of order. Other services include UPS Blue, 2 days, UPS Red, overnight, Federal Express, overnight. If you request, the shipping charge will be calculated and fixed at the time of order. Computer Boards, Inc. pre-pays and passes the carrier's charge on to you.

VOLUME & OEM PRICING

Volume discounts apply to quantities of a single item per shipment and will be applied automatically to your order. Customers interested in scheduled purchase orders and OEM pricing should call and ask for the sales manager.

Tired of that BIG COMPANY treatment?

You know the story. New data acquisition board, hot project, first signal hook-up and *phzzzt*, the board takes a 110VAC direct hit! You send the board back to be repaired and days or weeks later the board comes back to you with a terse message like the one below, "U6 & U9... etches and other problems, uneconomical to repair".

**Uneconomical to repair**. Nice. But they will be glad to sell you a replacement at full price...

What now? The project is already behind schedule and over budget and the department manager is asking why. This is not a good time to announce that the data acquisition board must be replaced at full price!

There is something you can do, even if you did not buy the board from ComputerBoards, Inc. You can get the protection of our *Harsh Environment Warranty*™ right now, today, no matter where you bought the board.

That is what John Tevik of The University of Minnesota did when his MetraByte DAS-8PGA proved "uneconomical to repair". There is his burned up DAS-8PGA, shipping box and RMA# 8550 letter below. To the right is a brand new ComputerBoards CIO-DAS08-PGH just like the one he bought for 60% off our already below the big guys list price.

In fact, he paid only $140 for the replacement. MetraByte would have charged $599. We shipped John a brand new CIO-DAS08-PGH with better performance, better software, better documentation and two better warranties! We shipped it the next day too!

Accidents happen. ComputerBoards stands by you when they do.
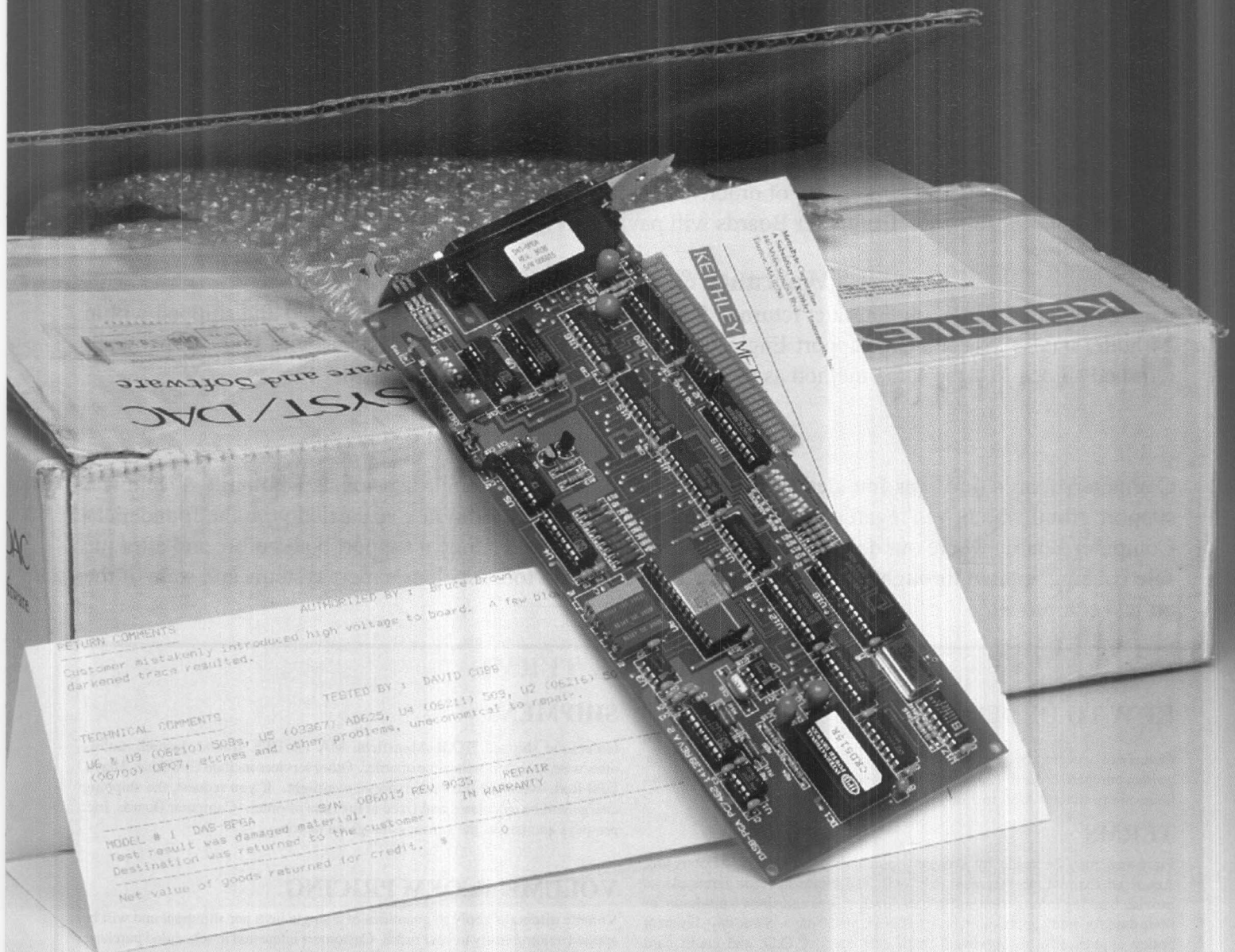
Protect your investment with ComputerBoards'
Harsh Environment Warranty ™

The ComputerBoards, Inc. lifetime *Harsh Environment Warranty*™ simply states:

"Any ComputerBoards, Inc. product which is damaged due to misuse may be replaced for only 40% of the current list price. I/O boards face some harsh environments, some harsher than I/O boards are designed to withstand. When that happens, just return the board with an order for its replacement at only 40% of the list price. ComputerBoards does not need to profit from your misfortune. **By the way, we will honor this warranty for any other manufacture's board that we have a replacement for!"** This warranty is honoroed world-wide at fixed USA prices!

When accidents happen, you want to know that the people you do business with will stand behind you, get you back to work quickly. The founders of ComputerBoards, Inc. have lots of experience in customer support. There is a better way to do business. At ComputerBoards we are doing it today.
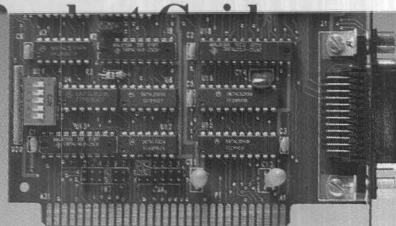
The CIO-PC2A IEEE-488 interface converts any PC/XT/AT/386 personal computer into an instrumentation control and data acquisition system. Connect up to 14 instruments using standard IEEE-488 cables such as the C488-2M, 2 meter IEEE-488 interface cable.

The CIO-PC2A is designed around the industry standard NEC uP7210 GPIB chip and the architecture of the CIO-PC2A completely matches that of NI's pre-1990 PCIIA GPIB interface.

CIO-PC2A-DRVR software is a complete library of routines for GPIB communication and control. Written entirely in C and including language interfaces for Quick Basic, Turbo Pascal and C and Microsoft C, The CIO-PC2A-DRVR allows you to create application programs for test, laboratory analysis and production control.

A GPIB.COM program compatible with National Instruments GPIB.COM allows you to use the CIO-PC2A in place of a National board with virtually any software language drivers and application programs. The CIO-PC2A is IEEE-488.1, but not 488.2 compatible, so commands which employ 488.2 features are not supported.
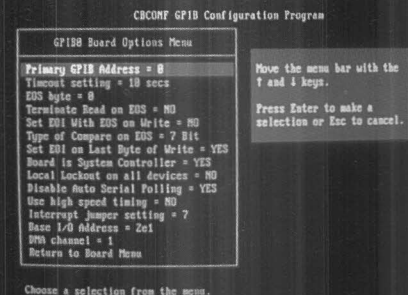
LWIN-DRVR
Complete Driver & On-Line Help Library for National Instruments' LabWindows Software

Complete I/O board driver and help file provides access to all ComputerBoards data acquisition and control boards and CIO-PC2A GPIB interface for National Instruments Lab Windows software.

If you have applications developed under lab windows from N.I., you can save money and have a greater selection of I/O boards to choose from by purchasing the LWIN-DRVR and ComputerBoards data acquisition boards.

Once installed, LWIN-DRVR operates exactly like the driver library supplied by NI for its own boards. A complete on-line users manual explains the syntax and variables of all calls to the ComputerBoards driver.
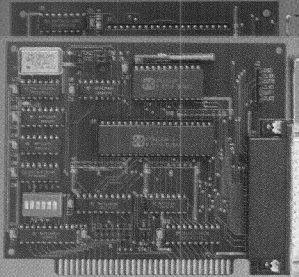
CIO-DIO24

CIO-DIO24/CTR3

24 TTL Digital I/O Lines & Three 16 Bit Counters
Direct to 82C55 (digital) and 82C54 (counter) I/O lines
Connector compatible with standard CIO-DIO24
Solid State Relay, Mechanical Relay Accessory
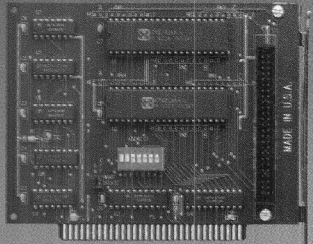
CIO-DIO48

48 Digital I/O lines
Direct 8255 Connections to I/O
All 8255 Modes Supported In Hardware
Solid State Relay, Mechanical Relay
Accessory
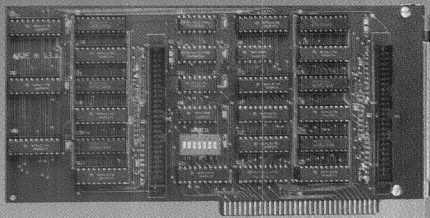
CIO-DIO48H

48 High Drive TTL Digital I/O Lines
15mA Source, 64mA Sink Current
Emulates Mode 0 of 8255 (PIO-12 Type)
Connector compatible with OPTO-22 & GORDOS solid state relay rack.
(Not compatible with CIO-ERB24 or SSR-RACK24)
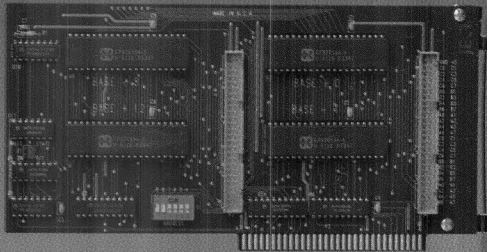
CIO-DIO96

96 Digital I/O lines
Direct 8255 Connections to I/O
All 8255 Modes Supported In Hardware
Solid State Relay, Reed Relay Accessory
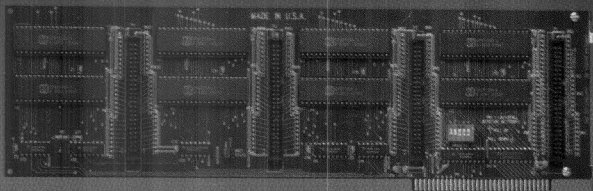
CIO-DIO192

192 Digital I/O lines
Direct 8255 Connections to I/O
All 8255 Modes Supported In Hardware
Solid State Relay, Reed Relay Accessory
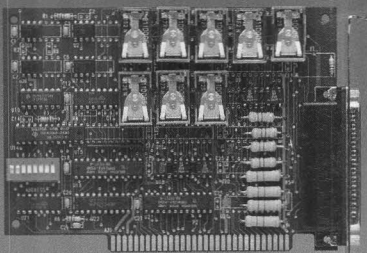
CIO-PDISO8

8 Electromechanical relay outputs
3 Amp contact rating
5 Form C, 3 Form A at connector
8 Optically Isolated Inputs
500V Isolation
Simple to program
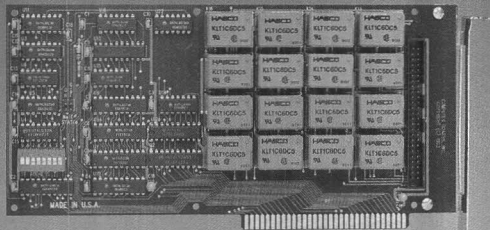
CIO-RELAY16

16 Electromechanical relay outputs
3 Amp contact rating
16 Form C
Simple to program
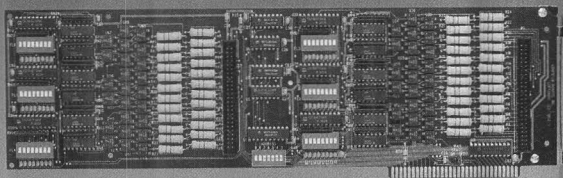
CIO-DISO48

48 Optically Isolated Inputs
500V Isolation
Simple to program
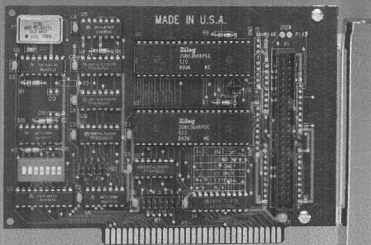
CIO-INT32

32 Bit Interrupt Vector, or
40 Bit, Bit Direction Programmable Digital I/O, or
Six 16 Bit Counters
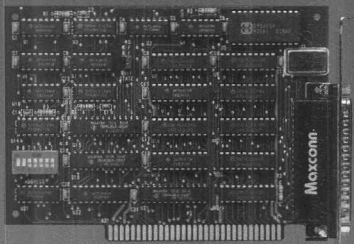
CIO-PDMA16

16 Bit Digital Input or Output
8 or 16 Bit Transfers
120,000 16 Bit Transfers / Second
250,000 8 Bit Transfers / Second
Auxiliar Gate and Control Lines
Internally Paced with On-Board XTAL
Or Externally Triggered & Synchronized
D.M.A., Interrupt or Program Transfers
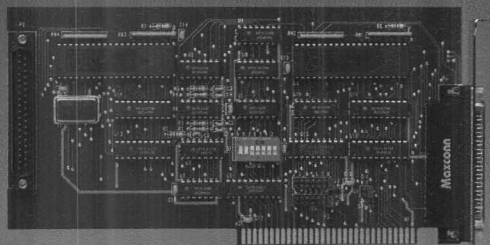
CIO-CTR10

10 Counter/Timers (AMD9513)
16 Bits per Counter, Chainable to 80 Bits
Square, Pulse, One-Shot and Complex Outputs
Inputs from DC to 7MHz Max
16 Digital Inputs & 16 Digital Outputs
1MHz XTAL On-Board
Precision XTALs 50ppm or better available.
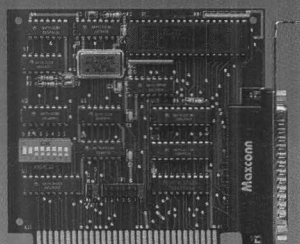
CIO-CTR05

5 Counter/Timers (AM9513A)
16 Bits per Counter, Chainable to 80 Bits
Square, Pulse, One-Shot and Complex Outputs
Inputs from DC to 7MHz Max
8 Digital Inputs & 8 Digital Outputs
1MHz XTAL On-Board
Precision XTALs 50ppm or better available.
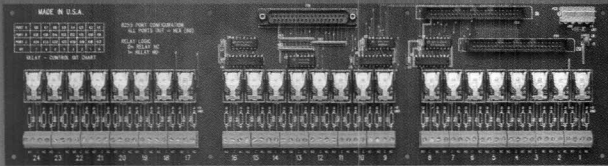
CIO-ERB24 & CIO-ERB08

24 Form C Relays (CIO-ERB24).
8 Form C Relays (CIO-ERB08).
Screw Terminals for 12-22 AWG wire.
37 Pin Connector mates directly to CIO-DIO24,
CIO-DAS1600 or CIO-DAS8 digital connector.
50 Pin header connects directly to:
CIO-DIO48, CIO-DIO96 & CIO-DIO192.
Powered from PC or externally.
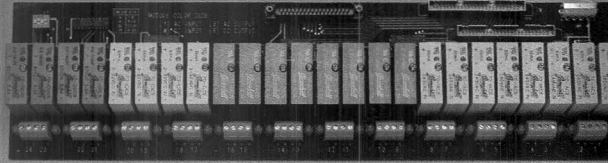
SSR-RACK24 & SSR-RACK08

24 Solid State Relays (CIO-ERB24).
8 Solid State Relays (CIO-ERB08).
Solid State Relays isolate from AC or DC, Sense or Switch.
Screw Terminals for 12-22 AWG wire.
37 Pin Connector mates directly to CIO-DIO24, CIO-DAS1600 or CIO-DAS8
digital connector.
50 Pin header connects directly to CIO-DIO48, CIO-DIO96 & CIO-DIO192.
Powered from PC or externally.

COMMUNICATIONS INTERFACES
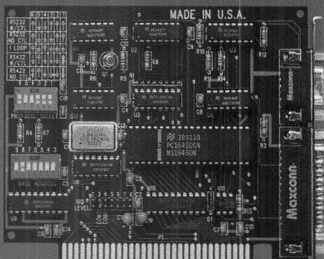
CIO-COM422

VERY LOW COST
RS-422 or RS-232 Communications
COM1, COM2, COM3 or COM4
Baud Rate to 56,000
Current Loop
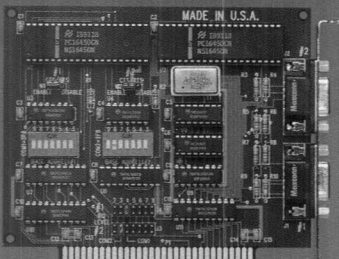
CIO-DUAL422

RS-422 Communications Interface
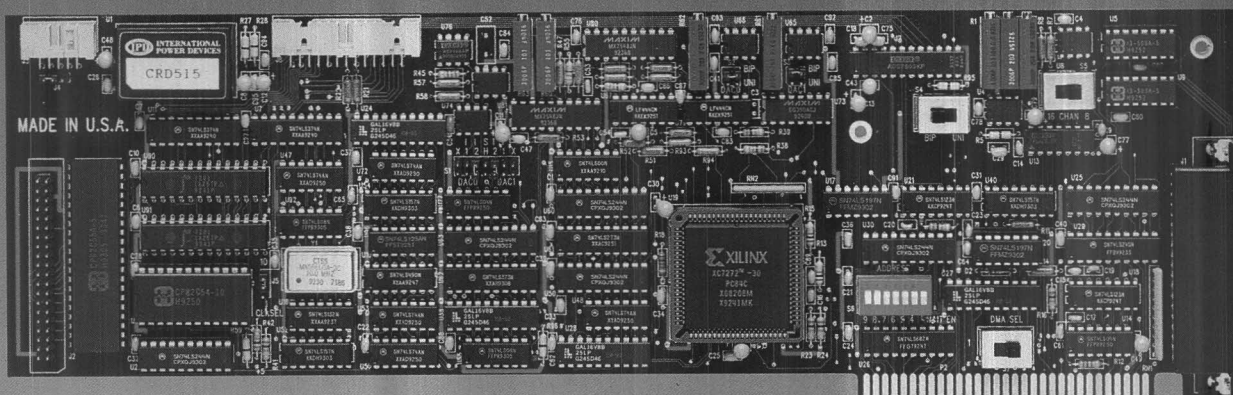Two Complete Ports
COM1, COM2, COM3 or COM4
Baud rate to 56,000
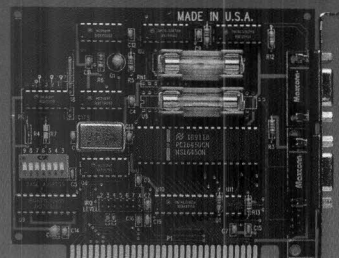
CIO-COM485

RS-485 Communications Interface
COM1, COM2, COM3 or COM4
Baud Rates to 56,000
RS-485 Network Component

NEW CIO-DAS1600/16 *NEW*

16 Bit Analog Input Resolution - 100KHz Throughput- DAS1600 Compatible

Features

16 Bit A/D Resolution
100 KHz Throughput
512 Sample FIFO buffer - Fast under Windows
DT-Connect Board-To-Board Interface
10uS Burst Mode
16 Single Ended or 8 Differential A/D Channels
Two 12 Bit D/A Converters
32 Bits Digital I/O
Programmable Gains of 0.5, 1, 2, 4 & 8
DAS-HRES, DAS-1600 Compatible

LOW PRICE!

The Best 16 Bit A/D Value Available!

When you expect to pay well over $1,500 for a 16 bit, 100KHz A/D board, it is shocking to find a high quality ComputerBoards' CIO-DAS1602/16 priced so low.

But you've come to expect that from ComputerBoards.

This catalog introduces many new and exciting products, all of which strain the very limits of price and performance: the dawn of PCMCIA data acquisition graces the front cover, the next level of low cost A/D performance is introduced here. Complete data sheets on both are on the pages within.

Lifetime product warranty, lifetime *Harsh Environment Warranty*™ top-notch technical support *and* the fairest prices in the business.

Thanks for shopping ComputerBoards!

DATA ACQUISITION & CONTROL